JOURNAL

VOLUME 9 NUMBER 10 • DECEMBER, 1953

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EAST ENGINEERING

CANADA WELCOMES the SPE

Conference Program —Page 17

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No Added Investment!

A SINGLE, limited market can lead to a *dead-end* on profits! Put *your* business on the road to bigger, steadier sales through *diversified* production. All you need to produce for the big flexible market is BAKELITE flexible Vinyl Plastic compounds. No special equipment, no extra investment! These materials can be fabricated on standard molding machines!

Check the properties of BAKELITE flexible Vinyl Plastic molding compounds, and judge for yourself what these materials have to offer in terms of *product variety, full usage of molding capacity.*

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to almost any degree, from soft and rubbery to semi-rigid . . . withstand long flexing without cracking.

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to high speed injection molding or extrusion. The temperature range for successful molding is very broad.

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ABRASION-RESISTANT parts for vacuum cleaners, injection molded of BAKELITE flexible Vinyl Plastic compounds. Quickly produced, these parts give long, lasting service, won't mar furniture. By Hungerford Plastics Corp., Rockaway, New Jersey.

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TRADE MARK

VINYL PLASTICS

TRADE MARK

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JOURNAL

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The Society of Plastics Engineers Journal is not responsible for the views expressed by individual contributors. Copy for each issue should be received at The Security Bank Bldg., Athens, Ohio before the first of the preceding month.

EVERY TYPE OF
MICA
for use as
fillers in
PLASTICS

Two associated companies offering every type of Mica . . . either the **Coarser** Dry-Ground **Mica** or the **Finer** Waterground and Micronized Mica . . . have representatives and warehouse stocks located for customer convenience in all principal cities of the United States and Canada.

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YOUR NATIONAL OFFICE

The **membership Campaign** is off to a fast start. Close to 100 new applicants in the first month!

Here is the picture by sections:

Section	Percent Increase
Baltimore-Washington	2
Buffalo	5
Central Ohio	0*
Chicago	2
Cleveland	7
Connecticut	1
Detroit	3.5
Eastern New England	1
Golden Gate	9
Miami Valley	1
Newark	3
New York	.4
Northern Indiana	5
Northwest Pennsylvania	4
Ontario	7
Philadelphia	3
Pittsburgh	50
Quebec	20
Rhode Island & S. E. Mass.	3
Rochester	6
St. Louis	0*
South Eastern Ohio	0*
Southern California	6
South Texas	16
Toledo	0*
Upper Midwest	8
Western New England	5
Total Increase	3.4

*Membership Chairmen please note.

Season's greetings and best wishes for a very prosperous New Year from your National Office staff.

P. L. Underwood
Executive Secretary

Glengarry Injecto-Weigh

GLENGARRY'S Injecto-weigh is now being successfully used in the molding of thin sections of plastic as well as heavy sections. Tests show an appreciable saving in material costs and a more positive assurance of product perfection.

The GLENGARRY Injecto-weigh is a weigh-feeding unit which delivers an accurate charge of plastic to injection molding machines. Because the amount of material in each shot delivered to the mold is consistent, crazing, warping, flashes, undesired variation in dimensions are eliminated.

The 500 series of the GLENGARRY Injecto-weigh embodies many improvements of the earlier models. All electrical connections and controls are on one side for easier operator control. The opposite side now has a removable panel for making quick adjustments. GLENGARRY also has available various sizes of standard weigh buckets and two sizes of interchangeable storage hoppers.

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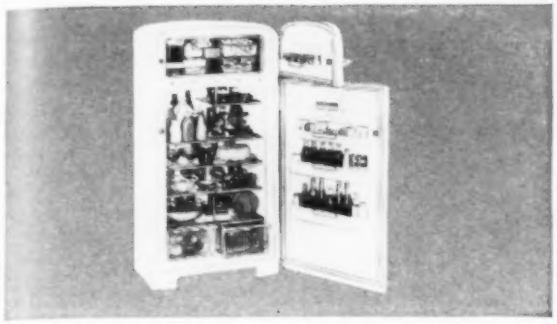
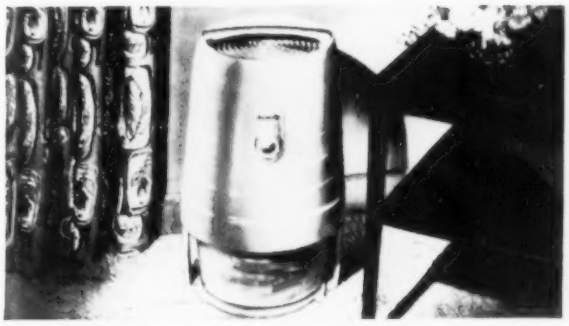
Further discounts on larger orders

Injection Molders Supply Co. 3514 LEE ROAD CLEVELAND 20, OHIO

Polystyrenes you helped to create in '53



You needed a plastic with high impact resistance and easy flow in molding for refrigerator door liners. Koppers Modified Polystyrene MC-305 was developed to solve your problem.



You needed a plastic with high impact, high heat resistance, fast setting, and an excellent finish for moisture conditioner housings. Your demand was answered with Koppers Modified Polystyrene MC-309.

You needed a medium impact, high heat-resistant plastic with high lustre . . . for radio cabinets where breakage and scuffing on ejection presented a reject problem. Koppers Modified Polystyrene MC-409 had the exact characteristics to do the job.

You needed a plastic with impact resistance, toughness, easy moldability, economy and ability to reproduce engineering details in toys. Koppers engineers recommended Modified Polystyrene MC-405 to fill these requirements.

KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temp.
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temp.
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temp.

• Here are four success stories about Koppers Polystyrenes. Each application presented its own special problem, and in each case a Koppers Modified Polystyrene was created to meet these special requirements.

The best polystyrene for you is the one that embodies the very qualities required to make your product more serviceable and more attractive. That's why the family of Koppers Modified Polystyrenes is constantly growing, at your request, to meet your needs.

Why not contact a Koppers representative for more information about the wide range of Koppers Regular and Modified Polystyrenes? They are anxious to help you select the exact polystyrene that will improve your product and lower your production costs.

Koppers Plastics Make Many Products Better and Many Better Products Possible.

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Plastics International . . .

SPE's Tenth Conference

"Plastics International," theme of the 10th Annual Conference of the Society of Plastics Engineers, will be given strong support by well known speakers and demonstrators in the plastics field from Great Britain, the United States, and Canada. The 1954 Conference will meet in Toronto, Canada, January 27, 28 and 29.

England's Archibald Renfrew, development director, Imperial Chemical Industries Ltd., will develop the idea that, while there is an undoubted need for new plastics, the "present trouble of the chemist is to imagine how these needs may be fulfilled."

Mr. Renfrew will speak on "Why More Plastics." His talk will be a challenge to plastics chemists and engineers, because he is prepared to deal directly with "the many disadvantages" of their product.

He will point out that the upper temperature at which plastics may be used is far too low. Also, many plastics have a poor resistance to weathering. However, he sees no reason for commercial pessimism: "Very large tonnages will be required;" "Growing industries will present new problems which only plastics can solve."

But Mr. Renfrew regrets there "seem to be no new revolutionary thoughts," and he is anxious to meet with other plastics engineers to pick up a few from them and present a few of his own.

Polyester resins and their industrial applications will be discussed by Dr. Irving E. Muskat, products division, Celanese Corp. of America.

Dr. Muskat points out that synthetic resins and plastic materials are usually classified as (1) naturally occuring high molecular weight materials, (2) thermoplastic resins, and (3) thermosetting resins. Polyester resins, often called "low pressure" or "contact pressure" resins, belong in the group of polymerizable thermosetting resins. The two types of polyester resins which are commercially available are those in which the polymerizable groups are in the alkyl part, and those in which they are in the acyl part of the molecule. The rest of his discussion will be limited to the unsaturated alkyd type resins.

He will discuss and demonstrate polyester resins, including a new thixotropic resin, which have been used to produce a great variety of products.

Hugo Becker, a metallurgical engineer with Plastic Mold Steel Sales, Newark, N.J., is predicating his talk on the basic hypothesis that "the quality of a molded part is no better than the quality of the mold in which it was produced." In his discussion of "Tool Steels for Plastic Molds—Their Production, Distribution and Application," the steel maker's views in terms of the future will be given.

Another speaker from the British plastics industry will be E. Davey-Turner, director of development and research, R. H. Windsor Ltd.

Mr. Davey-Turner presents a paper on extrusion in general, in which particular reference is made to the advantages of the multiple screw machines. He will also discuss the extrusion of one or two of the more difficult products, as well as some of the more eagerly awaited ones. He points out there is increasing demand for larger sizes of plastic pipes of almost all materials, and some of his time will be given to this most interesting subject.

Arthur N. Skeels, who owns Art Roll Leaf Stamping Co. in North Bergen, N.J., will talk on the decorating and marking of plastic products. Mold design engineers will be particularly interested in his advice about what they should look for prior to the actual making of the mold, "so that costs for decorating and time elements can be held to the minimum."

A summary of some of the recent work on the mechanical properties of polyethylene will be presented by Robert H. Carey, a development engineer with the Bakelite Co., in New Jersey.

Herbert O. Corbett, chief engineer-extrusion, Auburn Works Inc., Auburn, N.Y., will discuss extrusion machines in general, with reference to oil heated versus electrically heated equipment; selecting the proper drive for given conditions; good basic design in tooling an extruder.

(Please turn to page 8)

Speakers at the 10th SPE Conference

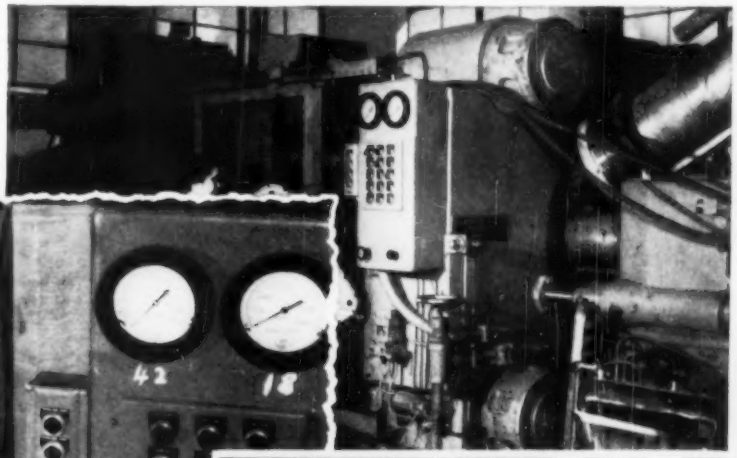
Archibald Renfrew

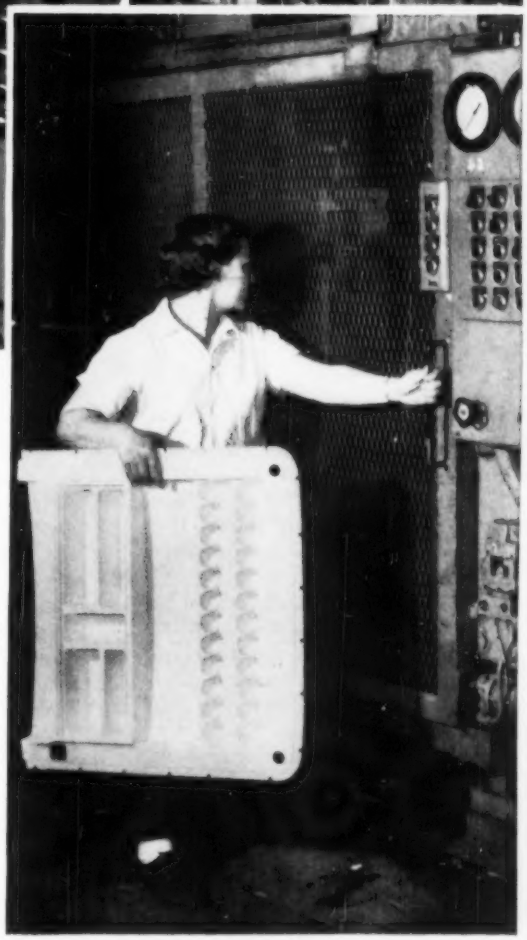
I. E. Muskat

Hugo Becker

E. Davey-Turner

92 OUNCE PIECE MOLDED EVERY





65 seconds

With The W-S 300 Oz. Plastics Molding Machine

Photos, furnished by General Machine & Tool Works, show production-action shots in their modern Walled Lake, Michigan plant. Here you see an International Harvester inner door liner, molded of Styron, coming off the production line. This single unit piece weighing 5 lbs., 12 ounces requires 784 square inches of projected area. Its average thickness is .115 inches. It measures 27½ x 28½ inches and it's a flash-free molding.

Speed . . . economy and maximum production efficiency is what you get with every Watson-Stillman Plastics Molding Machine. Capacities from 1 to 300 ozs. They're the first choice of the industry. Write for literature covering Injection, Transfer and Compression Molding Machines.

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Plastics International . . .

Arthur N. Skeels

Robert H. Carey

H. O. Corbett

Milton S. Greenhalgh

(Continued from page 6)

Milton S. Greenhalgh, supervisor of thermoplastic unit, General Electric Co., Conn., will discuss the controversial techniques of extruding dry blend compounds made from polyvinyl chloride resins. These depend primarily on two types of processing equipment, the mixer or blender together with the extruder. He points out that if an extruder could be designed with better compound or fusing action than the present type, the actual mixing of dry blend stocks would be considerably simplified.

Wilford D. Harris, plastics engineer, and F. J. MacRae, plastics technical service, both with Dow Chemical Co., Mich., will discuss the "whole new field of plastics fabrication established by the introduction of modified polystyrene in sheet form."

Robert C. Bartlett reports on industry's reaction to the SPE education program.

During the past year opinions of industry on the Society of Plastics Engineers Educational Program have been acquired by means of a questionnaire. Answers received cover the plastics industry in broad point of view. The plastics industry strongly favors the present SPE program for education of plastics engineers. In addition to the information requested in this questionnaire, other helpful facts have been uncovered by statistical analysis of the answers. This survey demonstrates the industrial interest in plastics engineers and may aid the educators in tailoring their curriculum to this demand.

J. S. Whitaker will report on some new copolymers.

Acrylonitrile can be copolymerized with styrene to give rigid, transparent materials that are substantially different from either polyacrylonitrile or polystyrene. The copolymers have higher mechanical strengths, better weather resistance and different chemical properties than polystyrene. They can be molded or extruded in conventional equipment and in this respect they differ from polyacrylonitrile. Incompatibility of the copolymers with polyacrylonitrile or polystyrene is further evidence of a true copolymer.

Resistance of commercial copolymers to foods, detergents, household cleaning solvents, oils, greases, low benzol content gasolines, battery acids, alkali and some cosmetics indicates a wide area of usefulness extending the scope of styrene homopolymers and alloys. Many copolymer applications require one or more of these chemical resistant properties plus the inherent toughness of the material.

Oriented copolymers in the form of stretched monofilaments exhibit the same improved mechanical strength,

(please turn to page 16)

J. S. Whitaker

Robert C. Bartlett

W. D. Harris

F. J. MacRae

POLYSTYRENE *Foam*

R. N. Kennedy
The Dow Chemical Co.

PLASTIC FOAM may be made by expanding polystyrene. The same clear polystyrene granules that are used for molding are expanded between thirty-five and forty times to yield a light weight rigid cellular material.* This foam appears white because of the refraction and reflection of light by its multitude of cell walls. These cells are not interconnected; thus the material is not a sponge; it is a true foam. Volume wise it is about 97% void space and 3% polystyrene.

In the early 1940's a large-celled polystyrene foam was developed as a buoyancy material for the Armed Services. Since then a finer celled material has found widespread use in many diversified fields: low temperature insulation, buoyancy, electrical, floral and display. Almost everyone in these fields is now familiar with this material, and even if you have not heard of expanded polystyrene as an insulation, you have seen it as Christmas tree decorations or in windows as a display piece.

The strength properties are primarily a function of density although cell size and cell wall orientation do have some effect. We produce polystyrene foam in a density range of 1.3 to 2.0 lbs./cu. ft. In this density range the strength properties are as follows:

Compressive Strength—10 to 35 lbs./sq. in.
Tensile Strength—30 to 100 lbs./sq. in.
Shear Strength—15 to 45 lbs./sq. in.

Expanded polystyrenes of higher densities will have correspondingly greater strength properties.

The first requisite of an insulating material is that characteristic which makes it a heat insulator, its K-factor or thermal conductivity. Expanded polystyrene has a K-factor of .23 to .28 BTU-in./sq. ft.-hr.-°F. at a mean temperature of 40° F. Such a K-factor compares favorably with that of other commercially available board form insulating materials. The range of thermal conductivity is due to cell size, the larger the cell the higher the thermal conductivity. As an example, our first expanded polystyrene produced had cells approximately ¼" in diameter, with a K-factor of .45 BTU-in./sq. ft.-hr.-°F. A very fine celled foam will have a K-factor as low as .22 BTU-in./sq. ft.-hr.-°F. This lowering of K-factor with smaller cells probably is due to a reduction in the amount of heat transferred by convection and by radiation.

Other thermal properties that may be of interest are: thermal coefficient of expansion, the same as pure polystyrene—between 2 and 5 x 10^{-5} in./in./°F. - and a specific heat of 0.27 BTU's lb./°F. at 40°F. The maximum recommended use temperature is 175°F. Above this temperature, polystyrene softens enough that distortion takes place.

The excellent water resistant properties are of extreme importance in its use as a low temperature insulating material. Not only does it resist the entrance and passage of water and water vapor, but the presence of water does not harm it physically either directly or indirectly by such things as mold growth and rot. Polystyrene absorbs very little water, and expanded polystyrene when immersed in water only picks it up on the open surface cells. This is termed water adsorption and is reported in two ways, less than 6% by volume (for volumes greater than a 2" cube) and less than 1 lb./sq. ft. of surface area. Water vapor transmission, that is water transmitted through as a vapor due to differences in partial vapor pressure, is very low, being less than 3 grains/sq. ft./hr./in. of thickness/in. of mercury vapor pressure difference.

Expanded polystyrene is produced as board, rough plank and log.

Electrical properties are very interesting because this foam possesses electrical properties most nearly approaching those of air of any solid material. The dielectric constant is less than 1.05 and the power factor less than 0.0002 over a frequency range of 10^2 to 10^5 c.p.s. This has led to its use in radar and other micro wave applications.

Many times the question is asked, "Is expanded polystyrene acoustical material?" From the appearance of its rough surface it would seem that it would have sound absorbing qualities. However, the surface cells, though broken, are closed, thus reflecting sound waves. Thus it cannot be considered a good sound absorbing material. It is comparable to wood.

There are many other properties which could be discussed, most of which are dependent directly upon the base plastic, polystyrene. Its chemical resistance is al-

*Trade name Styrofoam

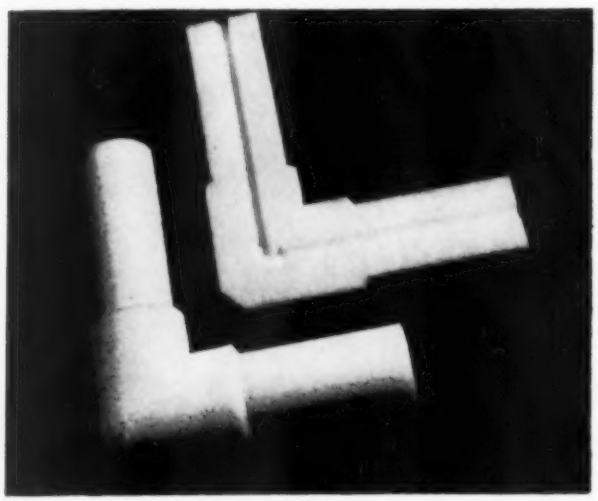
Installing expanded polystyrene insulation in milk cooler at the plant of Babson Bros. Company of New York at Syracuse, New York.

most exactly like that of polystyrene. It has no odor, either wet nor dry, nor does it sustain mold growth. It is not toxic.

One property which can be listed as a disadvantage and the one that has probably offered the most sales resistance is its burning characteristics. This objection now has been largely overcome by the development of a foam which has self-extinguishing characteristics. This material is colored blue for identification*. With minor exceptions the self-extinguishing foam has the same properties as the foam which has just been discussed.

We produce expanded polystyrene in two basic forms: cut boards, which are sold by the board foot, and rough logs and planks, which are sold by the pound. The cut boards are available in thicknesses of 1", 2", 3", 4" and 5" by 10" or 12" wide by 36" and 9' long. The rough logs and rough planks are available in a variety of sizes: approximately 5" x 15" x 9'4", 7" x 20" x 0'4" and 24" x 35" x 9' or 6'.

A characteristic of styrene foam that has immeasurably assisted its acceptance and use as a display and floral material is the ease of fabricating into various shapes. It can be fabricated by most woodworking techniques, using saws, lathes, routers, multiple carvers, and the like. In fact, simpler tooling and less power are required for fabricating this foam than for wood. It can also be cut to various shapes by using a heated wire. This is best done with an electrically heated resistance wire shaped to the curvature of the object desired. Some heat forming can be done, and thin sections can be successfully die cut.



Polystyrene foam offers an excellent pipe covering material for low temperature lines.

There are many adhesives available for bonding expanded polystyrene to itself and other surfaces. Not any adhesive, however, can be used. As an example, it is chemically attacked by most solvents other than alcohol and water. This precludes the use of many adhesives. It is non-porous, thus presenting a drying problem when bonded to itself or other non-porous materials with drying types of adhesives. It is also limited on the use of hot melt adhesives because of temperature limitation.

The surfacing and decorative finishing of expanded polystyrene is relatively simple if materials containing solvents which attack the foam are used. It has an ideal surface for adhesion of all types of plasters and weather coatings. It can be colored by the use of alcohol solutions of dyes or any of the new water dispersed type of paints.

Uses for expanded polystyrene are many and varied. However, the basic fields consuming the major amounts of foam sold are relatively few. They are:

a. low temperature insulation
b. floral, display and novelty
c. buoyancy

The low temperature insulation field potentially is by far the largest. It may be further broken down into several categories:

a. storage and freezer spaces, including not only stationary rooms but railroad cars, truck and trailer bodies, ships, and the like.
b. refrigerated equipment, such as household refrigerators, sharp freeze units, water coolers, and so on.
c. pipe and industrial equipment insulation which includes storage tanks and all types of processing equipment.
d. comfort insulation such as homes, and other buildings where the insulation is primarily to assist in maintaining the comfort of the occupants of the building. This category should also include roof insulation on industrial plants where often the insulation is not so much of a comfort as it is to prevent condensation.

Expanded polystyrene is now considered a basic raw material in the floral, display and novelty fields. In many applications its identity is lost. This is particularly true in the floral trade where it is used as a foundation for floral pieces. The display and novelty manufacturers cut, carve and color it into thousands of items, large and small. The possibilities of these fields are unlimited.

The first use of expanded polystyrene, buoyancy, is a relatively small but continuing market. The permanent buoyancy quality, that of not being destroyed by water, decay or corrosion, has lead to its acceptance as a replacement for air tight chambers in many types of boats —small metal boats, speed boats and even large yachts. It is also used for swimming rafts, floating docks, buoys and other types of floats.

There are other miscellaneous applications, any one of which could consume large amounts. Among these are: core material in structural sandwich panels, light dielectrical solid for electrical use, and packaging.

The information given only briefly describes the properties, handling characteristics and applications for expanded polystyrene.

* *Trade name Styrofoam 33*

Ivory Melmac Molding Material makes handsome, hard-wearing handles for Carvel Hall Cutlery. Molded by Michigan Molded Plastics for Chas. D. Briddell, Inc.

now! the ideal cutlery handle . . .

molded of Melmac®

For the first time, American Cyanamid's durable MELMAC melamine molding material has been used for cutlery handles. Result: a comfortable, sure-grip handle. Hard-to-break, it takes kitchen abuse without chipping or breaking. Heat-resistant, it is unharmed by automatic dishwasher hot water. Lightweight, it has the "feel" and heft of much heavier materials. Molded, it fits the hand for surer, safer carving and cutting. Its warm, glowing ivory color can't fade, crack, chip, peel or flake—it's part of the material itself.

As practical as it is beautiful, MELMAC is the ideal solution for many a molding problem. Both retail and commercial markets are handling more and more products molded of MELMAC . . . because MELMAC makes better products and because MELMAC makes *sales*.

Write today for complete information and successful case histories. Or ask to have a Cyanamid Technical Representative call.

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32-D Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited,
Royal Bank Building, Toronto, Ontario, Canada.

PHENOLIC *Foam*

J. D. Nelson
General Electric Co.

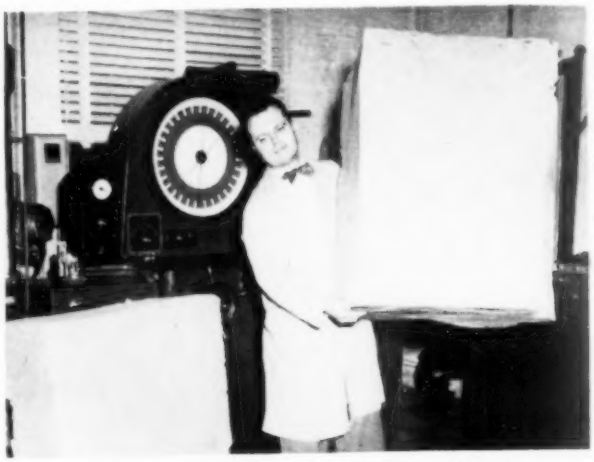
PHENOLIC FOAMS ARE made from liquid phenolic resins by a chemical blowing process in which the liquid resin is expanded up to 300 times its original volume. By designing a resin with the correct balance of higher molecular weight components and reactive phenolic derivatives, an exothermic reaction can be initiated through the addition of a curing accelerator, usually acidic in nature. If a gas liberating material is then included in the mix to provide the necessary expansion while the resin is in the process of curing, we have the basic requirements for a foaming formulation. Additional ingredients may also be added to assist in the control of density and to help the cell formation of the foam. In some formulations air is beaten into the resin prior to addition of the accelerator. This air functions as seeding nuclei for the expansion process as well as an additional source of blowing agent. Formulations with air beaten in will generally give a foam with a more resilient texture than those without air, although their compressive strengths will be reduced proportionately.

This process for conversion of a liquid resin to an expanded solid in a matter of 2-3 minutes without the need for application of any external heat or pressure is unique among expanded plastics. It makes possible the "foamed-in-place" technique in which the expanding resin assumes the shape and completely fills the space or cavity in which it is formed. Since it generates its own heat and since the equipment for foaming is so simple, it lends itself particularly well to field applications where other types of expanded plastics could not be used. The only equipment required is an open-end container for holding the liquid charge and an electric or air driven mixer for agitation.

The mixing containers should be equipped with a quick opening dump valve to permit rapid transfer of the activated charge to the cavity being filled. A typical cycle would include a premixing of resin with all other ingredients except accelerator for 1 to 3 minutes, addition of accelerator and mixing for 10 to 20 seconds, discharge of activated mix in 5 to 10 seconds, expansion and cure of mix in ½ to 2 minutes; for a total fabrication time of 1¾ to 5½ minutes. When properly formulated, the resulting expanded foam will completely fill the cavity and exhibit negligible after-shrinkage.

While the "foaming-in-place" technique appears to offer most advantages from the use of phenolic foam, it also is adaptable to the manufacture of molded, expanded parts from low cost molds and also expanded foam slabs which can be cut or shaped for specific purposes.

In this connection, the General Electric Company recently developed a new foaming process for the economical production of low density slabs of phenolic foam.



The lightness of phenolic foam is demonstrated by the ease with which this large piece is held.

This "counter-balanced" apparatus, on which patents have been granted, permits the foaming of large blocks of uniform density with a much more efficient utilization of the phenolic resin. It is particularly suitable for foam slabs in the density range of ½ lb. cu. ft. or lower. These are the densities that are showing considerable promise at the moment in packaging and related fields.

PROPERTIES

Phenolic foam is a light weight, expanded material in which both independent and interconnected air pockets are enclosed by solid resin films. Tests indicate that about ⅔ of the cells are non-interconnecting. The cured resin is inherently a brittle material; however, in the formation of phenolic foam, a heavier density layer is formed on all surfaces—even when the boundary surface is against air. This produces a "built-in" protective skin which considerably improves the rigidity and nonsetcling characteristic, particularly in "foamed-in-place" applications. The resultant foam properties and eventually the applications for the expanded foam itself are naturally tied in very closely with these basic characteristics of the expanded phenolic resin.

The mechanical properties for several density ranges of phenolic foam are presented in Table I. These are average values obtained on core sections with the higher density outer skins being removed. While these strengths are adequate for many applications and while the strength weight ratios are fairly good, they are not particularly

outstanding for those applications where structural strength is a major factor.

Some of the moisture resistance values for phenolic foam have been tabulated in Table II. This clearly shows the effect of the presence of interconnected cells, for while the cured foam resin itself is practically unaffected by water, the cellular construction does permit the penetration of some moisture. This can be eliminated for the most part, however, by the use of suitable coating materials.

This same factor is present in the buoyancy data shown in Table III. for immersion tests run in salt water. It is interesting to note the difference in residual buoyancy figures for the immersion "under surface" compared to immersion under 20 or 30 ft. heads of water. Apparently the increased hydrostatic pressure is sufficiently high partially to break down the cell walls, permitting partial moisture infiltration.

The cellular construction of phenolic foam together with its light weight and rigidity make it an excellent insulator for heat and sound. In Table IV the thermal conductivity of phenolic foam is compared with some of the more common insulating materials. As the figures show, the lower density phenolic foams are among the best insulators in the group. Additional data has shown that with the particular cell formation of expanded phenolic, there is a minimum foam density for optimum thermal insulation properties, this density being at or near 1 lb. cu. ft. At densities below this figure, the interconnecting cell structure becomes a more dominant factor, with a resultant drop off in insulation value, although the foam can still be classified as an efficient insulator.

While the presence of interconnecting cells in phenolic foam is not desirable from several viewpoints, this is not the case where acoustical insulation applications are concerned. Here the cell formation is ideal for sound deadening, since the sound waves can enter the open portion of the foam structure and be efficiently absorbed within. This is borne out with the data presented in Table V, which gives the results of a comparative sound absorption test made with a section of phenolic foam containing the higher density outer skin. It can be anticipated that even more favorable results could have been obtained if the outer skin had been removed, thus exposing a higher percentage of porus openings. This isolated test would indicate that the foam was effective over a wide frequency range.

In addition to the properties described so far, expanded phenolic foam possesses additional characteristics which are inherent with phenolic resins in general, namely a high degree of resistance to heat and chemicals. Phenolic foam can be used at temperatures up to 300 F continuously. In addition, it is classified as a self-extinguishing material, or in other words, it will not burn when the source of flame is removed. Both of these properties are extremely important in many applications where safety requirements and higher temperature operating conditions are factors. With the exception of certain alkalies, alcohols and ketones, the resistance to chemicals is excellent.

APPLICATIONS AND PROSPECTS

The largest volume of phenolic foam used to date has been in "foamed-in-place" applications where the light weight, rigidity, stiffening qualities, buoyancy properties and ease of fabrication were taken advantage of in the filling of irregular voids and cavities. When such spaces

(Please turn to page 34)

Physical Properties of Phenolic Foam

Table I
MECHANICAL PROPERTIES OF EXPANDED PHENOLIC FOAM

Property	⅓-1-½ lbs. cu. ft. Density	2-5 lbs. cu. ft.* Density	7-10 lbs. cu. ft. Density
Compressive Strength p.s.i.	0.8-5	9-31	45-130
Tensile Strength p.s.i.	-	4-35	35-75
Flexural Strength p.s.i.		24-40	75-230
Shear Strength p.s.i.	-	8-30	40-135

*Density range most common for "foamed-in-place" applications.

Table II
MOISTURE RESISTANCE PROPERTIES OF PHENOLIC FOAM

Moisture Absorption	2-5 lbs. cu. ft. Density	7-10 lbs. cu. ft. Density
At 100% Relative Humidity	13-51% by weight	10-51% by weight
At 50% Relative Humidity	1- 4% by weight	1- 5% by weight
At 20% Relative Humidity	½- 1% by weight	1- 2% by weight

Table III
SALT WATER IMMERSION DATA WITH PHENOLIC FOAM

	Test 1	Test 2	Test 3	Test 4
Density (dry) (lbs. cu. ft.)	4.1	1.9	2.6	8.8
Original Buoyancy (lbs. cu. ft.)	59.9	62.1	61.4	55.2
Buoyancy After Immersion Just (lbs. cu. ft.)				
Under Surface				
24 hrs.	53.3	—	—	—
48 hrs.	47.8	—	—	—
4 months	23.1	—	—	—
Buoyancy After Immersion Under (lbs. cu. ft.)				
20 ft. head				
24 hrs.	—	32.3	26.4	21.5
Buoyancy After Immersion Under (lbs. cu. ft.)				
30 ft. head				
24 hrs.	—	32.7	27.6	19.5

Plastics International . . .

(continued from page 8)

heat resistance, and weather resistance as molded copolymer shapes.

Low temperature mechanical data indicate a brittle point below -50 deg. F. Flexural strength and flexural work to break measurements to about -50 deg. F. show a continuing increase in these properties.

Comparative data charts and examples of molded objects will be shown to illustrate the areas where acrylonitrile-styrene copolymers are being used, and the relation of copolymers to other commercial materials.

Barney Kellam, senior engineer, chemical research dept., Hydro Electric Power Commission of Ontario, will present a paper covering plastic material problems in the power distribution field. He will discuss activities in plastics of the largest electrical utilities on the continent, giving details of three subjects to illustrate problems and the attempts to solve them. One of the problems is that of a plastic cable-fastener for supporting vinyl-insulated control cables in a vertical position and one that avoids cold flow. The stages in the development and the result of tests simulating operating conditions with long vertical cables suspended on the fastener are given. The second subject involves the experiences with polyethylene as a wire insulant in a very large 4000 volt network. Failures at joints and some due to environmental cracking are detailed with results of improvement in technique and materials. Experiences with the melt indexer are given. Finally, plastic pipe is dealt with, for water supply, electrical conduit and a special application in high-voltage power transmission. Some of the factors involved in the evaluation of plastic pipe for these applications are given.

These highlights from a few of the speeches and demonstrations to be made at the 10th Conference give some indication of the range and interest of the subjects to be covered. There can be no more stimulating way to profit from the knowledge of others than by meeting with them for that type of friendly discussion which is the strength of our great North American tradition.

LADIES PROGRAM

10th SPE Technical Conference

WEDNESDAY, JANUARY 27

Time	Function	Location
All Day	Registration	Foyer of Convention Floor
10:00 A.M.-1:00 P. M.	Informal Coffee Party. Members of ladies' committee to be available for guided shopping tours	Private Dining Room Main Mezzanine
2:00 P. M.-4:30 P. M.	Guided Tour of "Casa Loma" Toronto's castle on the hill. Tour concluded with afternoon tea	Casa Loma transport by Grey Coach Lines

THURSDAY, JANUARY 28

Time	Function	Location
9:00 A. M.-12 noon	Informal Coffee Party	Private Dining Room #10 Main Mezzanine
10:30 A. M.-12 noon	"Synthetic Fabric Show" by Nylon Division Canadian Industries Ltd.	Private Dining Room #10 Main Mezzanine
12:30-3:00 P.M.	Lunch at Club One Two fashion show following	
3:30-6:00 P.M.	Free time to prepare for banquet. Ladies' Lounge will be available for visiting, informal bridge & shopping assistants will be available if required	
6:00 P.M.-7:00 P.M.	President's Cocktail Hour	Banquet Hall or Room close
7:00-9:30	Banquet	Banquet Hall Convention Floor
10:00-12:30	Dance	Banquet Hall Convention Floor

FRIDAY, JANUARY 29

Time	Function	Location
9:00 A. M.-12 noon	Informal Coffee Party Shopping assistants available if required	Private Dining Room #10 Main Mezzanine
12:30-3:00 P. M.	Lunch followed by demonstration & talk on "Deep Freeze Methods & Hints in the Home" by The Hydro Electric Power Commission of Ontario	King Edward Hotel

Program

Tenth Annual Technical Conference

THE SOCIETY OF PLASTICS ENGINEERS, INC.

The Royal York Hotel — January 27-29, Toronto

Tuesday, January 26

The National Council will meet in Hall "C" from 9:30 until 5:00. National officers for 1954 will be elected at this time. Walter Oelman, National President, will preside over the morning session and luncheon, and the newly elected president will preside in the afternoon.

Section officers and directors are invited to be present at all Council meetings.

Wednesday, January 27

Functions

12:00-1:30	Journal Editors Lunch	Dr. Jesse Day Editor S.P.E. Journal	
12:00-1:15	Lunch for speakers and one moderator of afternoon session plus representative of Speakers or Program Committee.	A. McLean Carr-Harris to appoint	Imperial Dining Room Reserved Table

TECHNICAL SESSIONS

Symposium: Modified Styrenes—Developments and Applications

Moderator
A. E. Byrne, Manager Chemical Div.
Canadian General Electric Co. Ltd.

Location
Concert Hall, Convention Floor

Time		
(a) 1:45-2:05	Styrene/Acrylonitrile Co-Polymers	Dr. S. Whittaker Bakelite Company
(b) 2:05-2:25	Techniques & Applications of Modified Styrene Sheet ("475")	F. T. MacRae W. D. Harris Dow Chemical Company
(c) 2:25-2:45	Applications for Rubber Modified Styrene Molding Compounds	E. D. Hellyer Monsanto Chemical Company
(d) 2:45-3:05	"Kralastic"—a polymer of styrene/acrylonitrile/ butadiene in Pipe Fittings	Paul M.Elliott Naugatuck Chemical Division
(e) 3:05-3:25	Present & Future Applications of Heat Resistant, Modified Styrenes	C. J. Snyder Koppers Company Inc.
(f) 3:25-3:50	Discussion & Questions	
3:50-4:00	Recess	
4:00-4:45	"Why More Plastics"	A. Renfrew, Polythene Director, Plastics Division, Imperial Chemical Industries Ltd., London, England

Thursday, January 28

Functions

Time	Function	Chairman	Location
A.M. 7:45-8:45	Breakfast for speakers and moderators of morning sessions plus representatives of speakers on Program Committee. **NOTE:** Two tables to accommodate separately session A and B.	A. McL. Carr Harris to appoint 2	Private Dining Room #7, Main Mezzanine
P.M. 12:15-1:30	Lunch for speakers and moderators of afternoon session plus representative of speakers or Program Committee.	A. McL. Carr Harris to appoint	Imperial Dining Room Reserved Table
12:15-1:30	Lunch for Section Officials (Dutch Treat)	New (1954) President	Private Dining Room #7, Main Mezzanine
6:00-7:00	President's Cocktail Hour	New (1954) President	Bar in (or close) to Banquet Hall
6:15-7:00	Reception for banquet head table guests. Approximately 20-30	G. W. Beatty	Parlor "A" Convention Floor
7:00-9:30	**BANQUET**	Toastmaster to be appointed. Speaker, Dr. Emmett O'Grady	Banquet Hall Convention Floor
10:00 P.M.- 12:30 A.M.	**DANCE**		Banquet Hall Convention Floor

TECHNICAL SESSIONS—Morning

Session A

Time	Moderators	Time	Moderators	Location
9:00-10:25	B. Kellam, M.A.Sc., Hydro Electric Power Commission of Ontario	10:30-12:00	Frank W. Reinhart, Chief Organic Plastics Section, National Bureau of Standards	Concert Hall Convention Floor

Time	Subject
9:00-9:45	Reserved for prize
9:45-10:20	papers
10:20-10:30	Recess

Time	Subject	Speaker
10:30-11:15	Marking and Decorating of Plastics	Arthur N. Skeels, Art Roll Leaf Stamping Company
11:15-12:00	The Extrusion of Thermoplastic Film and Sheeting	George P. Kovach Foster, Grant Company

Thursday, January 28

TECHNICAL SESSIONS—Morning

Session B

Moderator
To be appointed by Educational Forum

Location
Parlor A Convention Floor

Time	Subject	Speaker
9:00-10:15	"The Plastics Industry Challenges Educators" —annual educational forum	To be organized by J. W. Lindau III
10:15-10:25	Recess	
10:25-11:20	Education Forum Continues	
11:20-12:00	Plastic Material Problems in Power Distribution	B. Kellam, M.A.Sc., Hydro Electric Power Commission of Ontario

TECHNICAL SESSIONS—Afternoon

Moderator
Dr. J. H. Shipley, Manager, Polythene Division
Canadian Industries Ltd.

Location
Concert Hall, Convention Floor

Time	Subject	Speaker
1:45-2:25	Polyester Resins and their Industrial Applications (to be concluded)	Dr. Irving E. Muskat Cellanese Corp. of America Marco Products Dept.
2:25-3:05	Tool Steel for Plastic Molds	Hugo C. Becker Crucible Steel Co. of America
3:05-3:15	Recess	
3:15-3:55	Liquid Polymers Combined with Epoxy Resins	J. S. Jorczak J. A. Belisle Thiokol Chemical Corporation
3:55-4:35	Arcing Tests on Plastics	Thomas J. Martin and R. L. Hauter Boeing Airplane Co.
4:35-4:50	Conclusion of Polyester Resins Papers	

Functions

Friday, January 29

Time	Function	Chairman	Location
7:45-8:45	Breakfast for Speakers & moderators of morning sessions plus representatives of speakers or program committee.	A. McLean Carr-Harris to appoint two	Private Dining Room #8 Main Mezzanine
12:15-1:45	Formal Lunch (a) President's Annual Report	W. F. Oelman National President	Ball Room Convention Floor
12:15-1:45	Lunch for speakers & moderators of afternoon session plus representative of Speakers or Program Committee.	A. McLean Carr-Harris to appoint	Reserved table at Formal Lunch

Friday, January 29

TECHNICAL SESSIONS—Morning

Session A

Moderator
To be appointed by George M. Prall

Location
Concert Hall Convention Floor

Time	Subject	Speaker
9:00-11:05	Symposium on Extrusion	To be organized by George M. Prall
(a) 9:00-9:10	Opening Remarks	
(b) 9:10-9:30	Dry Blending of Vinyl compounds	M. S. Greenhalgh General Electric
(c) 9:30-9:50	Types of Extruders	Herbert O. Corbett Auburn Button Works Inc.
(d) 9:50-10:10	Take-Off & Cooling Equipment	
(e) 10:10-10:45	European Developments in the Extrusion Industry	E. Davey-Turner R. H. Windsor Ltd. London, England
(f) 10:45-11:05	Question Period	
11:05-11:15	Recess	
11:15-12:00	Vinyl Paste Resin Dispersions—Today and Tomorrow	W. D. Todd B. F. Goodrich Chemical Co.

Session B

RESEARCH SYMPOSIUM, Parlor A Convention floor, organized by Bryce Maxwell

Time	Subject	Speaker
9:00-9:05	Introductory Remarks	Bryce Maxwell
9:05-10:00	Crazing of Polystyrene	E. E. Ziegler Dow Chemical Co.
10:00-10:30	The Theory on the Changes in Physical Characteristics of Plastics Caused by Radiation	J. W. Ryan General Electric Company
10:30-11:00	Properties of Multiaxially Stretched Acrylic Plastics	Irvin Wollock National Bureau of Standards
11:00-12:00	Adiabatic Extrusion	J. McKelvey and Bernhardt E. I. DuPont de Nemours & Co. Inc.

TECHNICAL SESSIONS—Afternoon

Moderator
E. W. Binkley, Manager—Plastics, Smith & Stone Ltd. Georgetown, Ontario

Location
Concert Hall Convention Floor

Time	Subject	Speaker
2:00-2:40	The Mechanical Properties of Polyethylene	R. H. Carey Bakelite Company Union Carbide & Carbon Corp.
2:40-3:20	Professional Activities Report	Dr. L. M. Debing Monsanto Chemical Co.
3:20-3:30	Recess	
3:30-4:10	Cutting Costs With Quality Control	Dorian Shainin Rath & Strong Co.

A Symposium on Vinyl Compounding

Part II

The Akron Rubber Group and the Cleveland-Akron Section of SPE jointly sponsored a symposium on Vinyl Compounding and Processing which was held on October 17, 1952 at the Mayflower Hotel in Akron. Over 700 interested members filled the ballroom to capacity to hear a panel of six experts from all phases of the vinyl-consuming industry answer questions on a wide range of topics.

Mr. J. C. Richards, B.F. Goodrich Chemical Company, served as moderator of the panel. Other members were B. K. Lyckberg, Firestone Plastics Company; Frank Steere, Steere Enterprises; K. K. Fligor, Goodyear; R. A. Mansfield, B. F. Goodrich; Don J. Siddall, U. S. Stoneware, and Frank A. Martin, The Hoover Company.

All of the discussion was recorded on tape, but since it ran to thirty-three pages it has since been edited and condensed by the panel members. This condensation retains the essentials of the discussion, since the answers to many of the questions were in a sense duplications. To conserve space further, recognition is not given to individual panel members for specific answers. The questions have been grouped according to subject matter into seven broad classifications.

CALENDERING

1. **WHAT ARE the merits of the inverted "L" type calender on thin plastic film?**

It is impossible to answer this question without comparing the inverted "L" type calender with other types of calenders. The inverted "L" calender was first designed for double coating fabrics with rubber and for plying up rubber on one calender.

Thin plastic film was first made on old three-roll rubber calenders and with the advent of four-roll, inverted "L" calenders, production was shifted to this type.

This type of calender makes it possible to run film at faster speeds because of the extra bank. More uniform and higher temperatures are possible, thus increasing the physical properties and eliminating cold streaks which show up badly in thin film.

In comparing the inverted "L" calender, run from the top down with the other commonly used four-roll calender, namely the "Z" type calender, we find that less crown is needed on the finishing rolls because one of them is backed by another roll. It is conceivable that a lighter roll might be used in this case.

The modern calenders, both "L" and "Z" are now being equipped with adjustable crown mechanisms, whereby the axis of one of the finishing rolls can be crossed in relation to the other roll, thus affecting a change in the amount of opening across the faces of the rolls.

There are certain merits of the inverted "L" and "Z" type calenders, but satisfactory film can be run on either.

2. **What are the merits of the "Z" type calender on thin plastic film?**

Assuming a thin plastic film means less than 8 mils thickness, it is doubtful that there is any real processing advantage when comparing a "Z" type calender to an "L" type with the cross axis feature. Without the cross axis on an "L" type calender, it is more difficult to produce uniform film in a wide range of flexibilities and gauges than on the "Z" type calender.

The operating personnel prefer the "L" type because the last bite is in a vertical plane, eliminating the possibility of foreign matter dropping into the product. There is another possible advantage in that some people feel that a longer dwell obtained on the fourth calender roll is an advantage in producing a good film.

The Maintenance Department prefers the "Z" type, because of the ease of handling rolls, replacing bearings, and general maintenance on the calender. It is possible to change rolls in half the time, and change bearings in one-fourth the time. This advantage is particularly important where a factory may have only one calender for production. The "Z" type was introduced to the industry, as I understand, primarily for running high speeds. However, it is doubtful that anyone is operating at speeds which would enable one to determine an advantage in this respect. Practically, it is impossible to run speeds in ex-

VINYL COMPOUNDING . . .

cess of 100 yds./min. without producing a low quality material.

3. What new properties in resins, plasticizers, stabilizers, etc. are needed in order to make possible calendering speeds of 150 yds. min. or more, and what changes in compounding techniques are felt desirable for operation of calenders at these speeds?

The factors limiting the speed of commercial calendering vinyl film are not primarily compound variables as implied by the questions. I would list the factors as: Scheduling, Mechanical, and Compound.

Scheduling is probably one of the chief deterring factors to high speed calendering since the average size order being processed through vinyl calendering plants is so small that more film would be produced in establishing equilibrium conditions of temperature, gage, etc., at 150 yds./min. than would be required to fill the order. The scrap loss in establishing equilibrium conditions at relatively low speeds is a major problem to most film processors today.

Mechanically, calenders have not been perfected sufficiently to properly wind up the film at high speeds. The take-up speed differentials must be great enough to permit even winding of rolls; and this produces rolls of increasingly strained film as speeds are increased. The differential cannot be reduced because the normal pulsation of the rolls in a take-off train, while negligible in comparison with common standards, is great enough to permit telescoping and wrinkling which are symptoms of this type of wind-up difficulty.

Compounding factors which must be solved for high speed calendering pertain to the temperature plasticity index of the compound. Resins and compound ingredients must be selected so that the severe agitation experienced in a calender bank during high speed operation will permit an equilibrium plasticity or viscosity at a temperature which will be below the thermal decomposition point and stick temperature of the compound. No work has been done in this direction and the usual plastic testing equipment such as mills and plastometers do set up a sufficiently high rate shear to study these effects.

4. Is there any way of calendering a thin sheet of vinyl onto a sheet of rubber and have them stick together? Would one polymer be better than another?

As far as I know, there is no way of calendering a vinyl film onto rubber and get good adhesion between the plies. It is conceivable, however, that a vinyl film could be stuck onto a rubber sheet by adhesives and some mechanism might be designed to do the entire job in one operation. If it were possible, I would think that the best chance for adhesion would be between a film made from the softer vinyl resins and a nitrile rubber.

PLASTISOLS

1. What mixers are available for plastisol and organsol mixing?

There are a number available, such as pony mixers, ball mills, heavy duty ribbon type, mixers that rotate and revolve, and counter-rotating type. Heat build-up during the mixing must be avoided.

2. Is it possible to extrude plastisols or organsols in a screw type plastics extruder?

Plastisols can be extruded, but organosols cause trouble because of the volatiles present.

3. What equipment is available for de-aereation (continuous) of plastisols?

A type of continuous de-aereator used commercially is the Versator which rotates the plastic under vacuum at sufficient velocity to force the material out against atmospheric pressure.

4. Has a perfectly drip-free plastisol been developed for dipping applications?

Under the right conditions drip-free plastisols dipping is possible. A number of factors, such as preheat, object shape, rate of withdrawal are important, as well as the rheological properties of the compound.

5. What effect does particle size have on physical properties of fused film obtained from a plastisol?

As long as particle size is not excessive the effect of size on physical properties is largely indirect. The smaller the particle size, the greater the tendency to absorb plasticizer. This requires addition of extra plasticizer to arrive at comparable hardness, and also to maintain viscosities in a workable range.

6. How can viscosity of a vinyl plastisol be held at a constant level during aging?

The viscosity of a vinyl plastisol will increase substantially during the first twenty-four hours, and from then on will increase gradually.

The right choice of plasticizers and stabilizers will minimize viscosity change but will not elimnate it.

7. Are there additives, other than volatile organic materials, for use in vinyl plastisols for the lowering of viscosity?

Some wetting agents, such as lecithin are helpful. Some new resinous type materials also have shown promise.

8. In preparing a plastisol what factors determine whether the final dispersion is thixotropic or dilatant in nature?

Most plastisols are both dilatant and thixotropic. The choice of resin, filler, plasticizer, and stabilizer will determine the rheological properties. Certain metallic soaps increase thixotropy substantially.

9. Can you build thixotropy into a plastisol without a ball mill or a three-roll mill?

Method of processing seems to have little effect on the thixotropic characteristics of a particular compound. Therefore, a ball mill or three-roll mill is not required in making a thixotropic plastisol.

10. Describe the stabilization of clear plastisols.

In general, tin stabilizers give the best clarity, although a Barium Cadmium system probably will give the best aging characteristics.

11. Describe a method of determining viscosity of a vinyl

plastisol that will correlate with the amount of weight pick-up on an irregular-shaped fabric, such as cotton glove liner?

So many factors are involved that no such method is presently available.

12. **Is there a sure way to tell when a vinyl product of fairly heavy gage (i.e., 0.125 or over) is properly fused?**

A check of physical properties, such as tensile, elongations, or tear is the surest method. An experimental method is to immerse the test piece in a solvent, such as methyl ethyl ketone, An improperly fused compound disentergrates rapidly whereas a well fused compound is swelled slowly.

13. **Is there a rule of thumb for calculating the rate of heat transfer through plastisols and organsols?**

A very general rule is one inch per hour in a circulating air oven at 175° C.

OTHER PROCESSES

1. **Are silicone type mold release agents effective in plastisol molding?**

The silicone type mold release agents, when properly used either as an emulsion or in pure form, are very effective in plastisol molding. However, other release agents prove equally as effective as the silicone.

2. **What causes perspiration staining of clear vinyl? How can it be eliminated?**

The staining is probably a migration of something into the vinyl. Possibly it is an ammoniacal compound. The problem is not unique to PVC. It was also a big drawback in making steering wheels for automobiles. I would suggest that you might plasticize the PVC with "Arrid."

3. **Can you coat linoleum with a vinyl solution for better wear?**

Under very closely controlled conditions of formulating a vinyl solution and of applying it to linoleum, it is theoretically possible to increase the wear of linoleum by the application of a vinyl solution. However, although it may work in theory, and advertisements say that it is possible, the practical application of such a solution over linoleum, particularly after it has been in use, has indicated below average results. The biggest difficulty is not one of physical wear but one of adhesion and of moisture penetration between the coating and linoleum which causes it to lift, lose its adhesion and become scuffed off, resulting in a floor which exhibits a poor appearance and difficult maintenance problems.

4. **Is there anything than can be done to improve the heat transfer properties of vinyl resins?**

As you know, the heat transfer properties of vinyl resins are very low. Improvements can be made by compounding with large amounts of carbon black. In order to make an appreciable improvement, however, it is necessary to use 100 to 200 parts of black on 100 parts of resin. Even with these amounts of loading, the heat conductivity is not as good as glass which, of course, isn't the best for heat transfer.

5. **What are the relative importance and advantages of polyethylene, butyrate, polystyrene, and PVC in rigid pipe?**

To briefly compare the relative importance and advantages of polyethylene, polystyrene and PVC in rigid pipe would simulate the comparison of a horse, a cow, and a dog. Each has its place and each has its particular advantages and disadvantages. However, in the general classification of rigid pipe, assuming that there would be other conditions, particularly in its operation, which would affect its choice, one has to consider the following possibilities:

A. The initial cost versus the specific gravity is a virtue which dictates the choice of polyethylene, butyrate, polystyrene, and PVC in that order.

B. For certain applications, the color possibilities from a transparent clear pipe to a transluscent opaque pipe may dictate the choice, and in that case, the order of preference would be polystyrene, butyrate, polyethylene, and PVC in that order.

C. In the use of rigid pipe, the qualification may be centered around its absence of toxic materials, taste and odor and in this respect the problem becomes more complicated with the choice being polyethylene and butyrate followed by polystyrene and PVC. However, it must be stated here that polystyrene and PVC can be made to qualify for this application.

D. Among the most important considerations for pipe, one has to consider the chemical resistance. Here the choice lies in not just its overall resistance to reagents, but other physical properties that are required. For general uses, PVC, polyethylene, butyrate, and polystyrene would be chosen in that order.

E. Physical and thermal properties will select many of the materials and in this category PVC would be chosen as the recommended material whereas polystyrene, butyrate, and polyethylene would have to be selected solely on the basis of the degree of physical properties needed and the extent of the temperature involved.

F. The production of the pipe has its problems but a pipe is worthless if it cannot be joined to itself. If any of the materials exhibit difficult problems of coupling, this is a point which will decide against it in its application as a pipe. Considering the coupling problem and the fittings, butyrate, polyethylene, polystyrene, and PVC would be listed in that order of preference.

6. **Commercial vinyl resins differ somewhat in molecular weight. What effect does this have on the processability and physical properties of compounded vinyls of similar hardness?**

Processability and physical properties of compounded vinyls vary widely with molecular weight. In general, the lower the molecular weight, the easier the processability and the lower the temperature requirements for compounding, calendering or extrusion. The physical properties deteriorate with lower molecular weight as follows:

Tensile	Lower
Low Temperature Properties	Poorer
Impact Resistance	Poorer
Heat Distortion Resistance	Poorer
Chemical Resistance	Poorer
Solubility in Organic Solvents	Better

(please turn to page 24)

VINYL COMPOUNDING . . .

7. Can stabilization requirements be correlated with intrinsic viscosity of vinyl resins?

In general, the stability of vinyl resins is poorer as you go down in molecular weight. However, since processing temperature also goes down resulting in less heat history, the two factors usually compensate for each other. Stated specifically, a vinyl resin which can be processed at 300° F. is not nearly as stable as a vinyl resin that requires a 350° processing temperature. However, the stability of the lower molecular weight resin at 300° F. is generally equivalent and, in some cases, better than the stability of the higher molecular weight resin at 350° F. However, the stability against conditions under which the finished product will be used will be basically poorer for the lower molecular weight resin. Therefore, stabilization against conditions must be considerably better. As a specific example- light stabilization of the lower molecular weight resin will be much more difficult and will require better stabilizers than will be necessary with the higher molecular weight types.

8. Are there any vinyl films suitable for lamination to liner fabrics for use in calendering soft and tacky natural and synthetic rubbers onto, that will not pull off the fabric with repeated use?

I believe that a vinyl-coated fabric could be designed which would give good service in contact with rubbers. The primary considerations would be:

A. Temperature of service. The rubber should not be stripped from the liner at temperatures exceeding 125-150° F.

B. The plasticizers employed in the vinyl compound should be of a low migrating type so the the rubber is not affected by contact with the vinyl and so that the vinyl will not stiffen due to loss of plasticizer to the rubber.

C. The vinyl must be anchored thoroughly to the fabric. A solution or plastisol primer is recommended for this.

9. Has there been recent work released on plasticizer migration?

Yes. The question of plasticizer migration has received a great deal of attention during the past few years, particularly in the film and sheeting branch of the industry. "The Proceedings of the Third Annual Film, Sheeting, and Coated Fabrics Conference" sponsored by S.P.I. contain a paper on migration by J. R. Geenty which reviewed briefly work in this field, and proposes a new test in which the plasticizer is continuously absorbed by a finely divided silica powder in intimate contact with the sample.

There is also an account of further work on this type of test published in the September 1952 RESIN REVIEW.

Schultz in the July, 1952 A.S.T.M. Bulletin also shows that the rate of extraction of plasticizer in water greatly increased when the water is continuously changed or when it is agitated with activated carbon.

Another publication somewhat older is that of Small in the Journal of the Society of Chemical Industry, January, 1947, in which he arrives at much the same conclusions. Small showed that the rate of diffusion of the plasticizer in a surrounding gas is generally the rate-controlling factor rather than the rate of diffusion in the solid phase.

All of these references prove that the rate of migration of plasticizer in the solid phase is dependent on the rate of removal of the plasticizer from the surface.

10. Are there any new theories in regard to the formation of "fish eyes" in vinyl film and sheeting?

To the best of my knowledge no new theories have been projected which can positively explain the formation of fish eyes. In my opinion, I think that the problem resolves into combinations of the old theories and these are:

A. That fish eyes are caused by an agglomeration of super polymers during the polymerization. In other words, they could be formed by an uncontrollable, abnormal growth of a small percentage of the polymer.

B. That fish eyes are caused by the presence of high molecular weight tails or that the problem revolves around the molecular weight distribution being prominent in the high molecular weight portion of the batch.

C. That the fish eyes are produced during the drying stages of the resin and that certain portions of a batch moving through the entire process are subjected to variations in heat.

D. That fish eyes are some form of cross linkage which may be formed during the polymerization.

E. That fish eyes are formed during processing. The particles are dispersed but for some reason or another retain their particle identity and are not completely fluxed. These would then show up as discontinuities on the surface or throughout the thickness of the film.

The answer lies in any one or a combination of the points as set forth.

11. What advances in the opinion of the panel, will be made within the next ten years in the vinyl field?

The vinyls will continue to expand at the expense of rubber in the automotive field. All of the window channeling in automobiles which amounts to 15-20 lbs. per car should, in the next ten years, be 100% vinyl.

The flooring industry continues to convert to vinyl and this trend seems to be increasing rapidly.

Wire and cable should continue to increase and it is possible that vinyl will eventually replace lead as sheathing material.

Rigid vinyls should be well established in the chemical industry for piping and in corrosion resistant structures of all types. It is now conceivable that rigid vinyl would become well established in the building industry in the next ten years.

Film and sheeting have still not approached their ultimate volume and should continue to grow as new improvements in materials and printing and embossing become wide-spread.

There are many untouched applications in the plastisol and organosol field.

The molding end of the vinyl industry has been relatively neglected. When we learn how to handle these materials more effectively or when the chemical manufacturers give us better materials, injection molding will be very competitive with mechanical rubber goods.

In spite of pessimism expressed earlier, relative to high speed calendering, it is bound to come in ten or twenty years. Another item which will use large amounts of PVC is vacuum molding from sheets. Sponge vinyl also has a lot of possibilities. New plasticizers and stabilizers will undoubtedly make vinyls better aging and less susceptible to attack by solvents.

Refrigerator gaskets are now rapidly replacing rubber, and are doing a good job. Conveyor belts in England are replacing rubber in the mines. They will probably also take hold in the food industry.

In conclusion, it is felt that vinyls are still enjoying a fairly steep growth in volume which, although leveling off, could still result in a substantial increase during the next ten years.

THE *Injection* MOLDERSCOPE

By A. R. Morse

President, Injection Molder's Supply Co.

"It is the freedom to disagree, to quarrel with authority, in intellectual matters to think otherwise, that has made this nation what it is today." Dr. James B. Conant

I NOMINATE for the injection industry's Hall of Fame the Model 10A Reed-Prentice machine. (See illustration of Model 10A Reed now located in modern new plant of Mitchell Parker Mfg. Co., Pittsburgh, Pa.) This popular press was made from 1938 through 1946 and then discontinued, because "manufacturing costs became too high." Today, these presses used, bring what they sold for 10 years ago new. They are easy to maintain, and we believe that no more popular or universal press is in use. If manufacture of the last 1946 models were resumed today without any so-called improvements, the press would still compete with every 1953 4 oz. in performance—that's what molders in the know think of the Reed Model 10A! That's why we nominate it for the record as the industry's top performer!

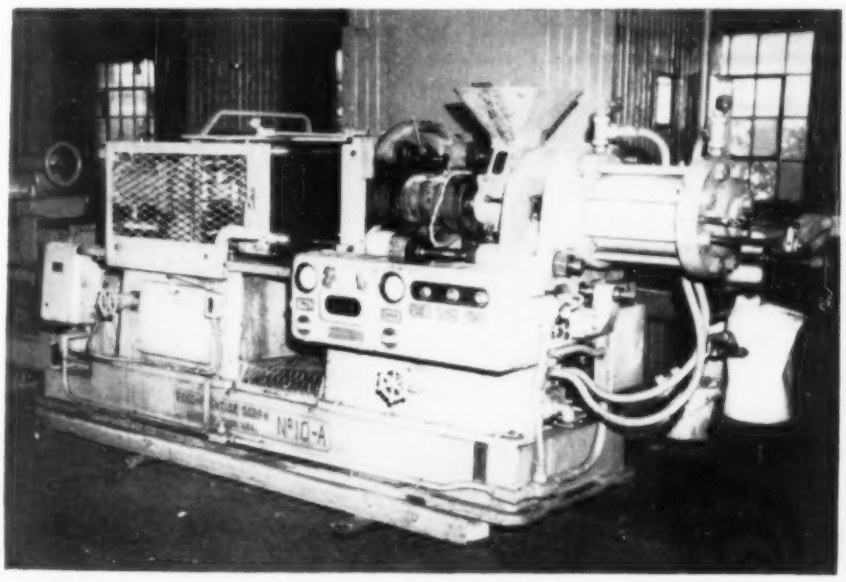
Signs and Portents

An August Wall Street Journal listed a sizeable middlewestern injection plant for sale. The New York Times in late September offered a 25 machine plant for sale at 50c on the dollar. Half of the machines were listed as less than 2½ years old. Most were over 16 ounce capacity or over. Top capacity 200 oz. The reason given for sale—owners wish to retire! I'd give $10.00 to know if the owners **really** wished to retire, or if they saw some handwriting on the wall not given to the average injection molder to read. 25 presses is in one way a large plant, but overhead must be high and competition from shops with only two or three 16 oz. presses is pretty keen—not ruthless, just in line with comparative costs of running 4 vs. 25 presses! The trend as I have said is to be small (4-6 presses) or very large (50-100 presses). In between these ranges, costs get out of balance—out of hand, and it is interesting to note these two offers of plants for sale in this middle size range. Shrewd observers have remarked too, that some adjustments are going to be forced on the injection industry because our product quality has too often been subordinated to price, speed records or other factors, as this column is pointing out from time to time.

Hat's off to Modern Plastics

In the September, 1953 issue of Modern Plastics, this sedate paper took off its usual silken gloves and struck out against thin section molding and poor quality merchandise which is appearing here and there on the market. Under the heading "It Could Happen Again," Modern Plastics lashed out vigorously at those molders who are cutting molded part wall sections and producing inferior molded articles just because of the fact that some of the new styrene copolymers are tougher than the styrenes used to be. They point out what happened in 1946 when the market was flooded with flimsy toy articles that reacted seriously against the injection molding industry and they point out that it could happen again. This trade paper as a general rule is very polite and dignified in its editorials and it is a real pleasure to read one in which they take a firm, outspoken stand. As a general rule, a trade paper of this kind which relies on advertisers for its chief revenue is very reluctant to take a positive stand and to strike out against any trade practices of its advertizers. The editor of Modern Plastics is to be congratulated on his courage and foresight in warning the injection molders what is going to happen to them if they do not take steps to produce better quality parts and to use more plastics in them. Both the SPI and the material companies could help in this connection and the individual members of SPE also should be enlisted in a campaign to produce molded articles which have sufficient wall section to allow them to stand up in use. In the injection molding industry, we are all too prone to try for speed records and high production rates and I believe that the day is at hand when we are going to have to look at quality instead of speed. Basically, our trouble is still due to the fact that we and others look at plastics as substitutes and very, very few injection molders have ever stood up for injection molded plastics as production items in their own rights. There is no reason why injection molded plastics cannot compete with stampings, castings, or any other type of part provided enough plastic is used in them to make the part substantial and of good quality throughout.

At any rate, Modern Plastics Magazine is definitely to be congratulated for their fine editorial in the September, 1953 issue and for the courageous stand they have taken against the injection molding of junk housewares, toys and other products that reflect on the character of our entire injection industry.



Model 10A Reed-Prentice Injection machine. Nominated for the Equipment Hall of Fame as an all time top performer.

AROUND THE WORLD

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AUSTRALIA

AUSTRALIAN PLASTICS

Vol. 8, No. 95, June 1953

Abstracter: Albert Lightbody

PROCESSING AND APPLICATION OF RIGID PVC. By W. Ehlers

Rigid polyvinyl chloride processing methods as forming, shrink plating on metal, extrusion, injection and welding are described with attention to the probable difficulty that would be encountered. The use of PVC in pipe lines and acid-proof ventilators is given attention with emphasis on fabrication and assembly. Films and foils in packaging use both electronic welding and hot wedge sealing.

LEADING PLASTICS MANUFACTURER SPEAKS ON CUSTOMER EDUCATION. By E. K. Stewart.

Manufacturers are undertaking a program of education of school children about plastics by conducted tours as well as aiding in school projects on plastics. Technical colleges are including courses in plastics instruction. The informative labeling on plastics articles, while good, is completely inadequate to eliminate dissatisfaction on the part of the customer.

TIME VERSUS LUMINOUS CEILINGS. By D. E. Spencer and L. F. Martin.

A luminous ceiling is a uniform, perfectly diffusing source of light that covers the entire ceiling. By the use of fluorescent lamps installed in a space between the original ceiling and sheets of translucent plastics, a luminous ceiling can be obtained. High efficiency is obtained if (1) Above the lamps use a flat ceiling without obstructions (2) Paint the ceiling above the lamps white with reflectance 80% (3) Keep the luminous ceiling comparatively shallow (4) For uniformity keep the distance between lamp centers less than 1.5 times the distance from the lamp centers to the diffusing plastic (5) Average wall reflectance must be at least 50% (6) Average floor reflectance must be at least 30%. The advantages of these luminous ceilings are many: in reduced glare, lack of shadows, and reduced contrast of surrounding areas.

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DENMARK

PLASTIC

Vol. 3, No. 6, 1953

Abstracter: Erik R. Nielsen

PHENOLIC FOAM PLASTIC. Bakelite Corp., N. Y.

Discussion of the manufacture of foamed phenolics and of their use in the packaging field.

DETERMINATION OF MOISTURE IN PLASTICS AND SYNTHETIC FIBERS. E. Mantzell.

The Karl Fischer method is applicable to a number of plastics and synthetic fibers. Usually less than ½ hour is required for the analysis.

ARALDITE RESIN ADHESIVES. Meyerhans.

Review of the properties of Araldite adhesives and a detailed discussion of application techniques.

COURSE IN PLASTICS. R. E. Helmer.

Central Technical School, Toronto, Canada, offers a 4 year course to prepare young men for a career in the plastics industry. A detailed description of the course is given.

PROPERTIES AND FABRICATION OF PLASTICIZED POLYVINYL CHLORIDE POWDER. S. J. Skinner.

Powdered plasticized polyvinyl chloride can be extruded in most extruders, with only minor deviations from standard practice. The extrusion rate is faster than for granular vinyls, and the extruder capacity increases linearly with the speed of the screw. The extruded products show greatly improved aging characteristics with respect to electrical properties, as compared to the products prepared from granular material.

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GERMANY

KUNSTSTOFFE

Vol. 43, No. 9, September 1953

Abstracter: Anne Schwend

HOT SHAPING AND WELDING OF THERMOPLASTICS SEMI-FINISHED PRODUCTS—O. Dammer.

A reprint of an address held at a Plastics Colloquim in July 1953, outlining the conditions under which shaping and welding of semi-finished products like tubes, profiles, boards and films can be accomplished. Means for preheating and the different processes of bending, drawing and deep drawing, punching and blowing as well as welding with hot gas welders, with heating elements, friction or high frequency are discussed. General rules to be observed are briefed. Not only the long life of thermoplastics, correctly processed, but also the low cost of production in comparison to formerly used materials makes them a desirable element in the construction of many kinds of machinery, apparatus, building and household equipment, in planes and automobiles, for packaging containers, etc. etc.

INJECTION MOLDING OF THERMOPLASTICS—W. Laeis.

A history and survey on the injection molding technique of thermoplastic materials, encompassing machinery, molds, materials and general rules for the molder.

THERMOSETTING RESINS FOR THE MOLD CASTING INDUSTRIES.

Messrs. Johannes Croning of Hamburg have developed and the Reichhold Chemie AG. of Hamburg have started production of powdered phenolic resins under the name of "Crustaphen" for the production of sand

molds for mass articles. A suitable kind of sand is mixed with 4 to 8% of powdered phenolic resin plus a curing agent and cast on a metallic preheated model. The melting resin bonds the sand into a crust which is baked in the oven together with the metallic model for a few minutes and then removed. Own developments and the experience of the Reichhold Chemicals Inc. with "Foundrez 7500" contributed to this new process.

PROGRESS IN STRESS OPTICS—Dr. Ludwig Foppl.

Plates of polyester resins—VP 1527—produced by Dynamit AG, were developed for use in stress optical research. Though less active as regards stress optics than formerly used phenolic formaldehydes, models remain utilizable also after repeated tests over long periods and do not show any deterioration of the edges. The apparatus used by Dynamit A.G. as well as the essence and effect of stress optics are discussed, so are photographs of isochromatic lines obtained with the help of either monochromatic or white light. Spatial stress concentrations created at elevated temperatures may well be investigated when chilling the model under load and thus freezing the stress optical effect which will not change even after cooling down to room temperature. Models may then be cut into pieces and stress effects analyzed with the above apparatus.

THERMOSETTINGS FOR LARGE MOLDED PARTS—Th. Henne.

A survey of the suitability of thermosetting plastics for large parts, proper mold construction and molding technique and adaptation of design of molded part to given molding possibilities. First attempts to manufacture laminated car bodies, undertaken 15 years ago already, are described. Development in the U.S.A. is discussed by citation of an article by J. B. Alfers, published in Modern Plastics, November 1952, about the molding of large-sized glass fibre reinforced boat bodies and the sundry methods used therefor.

PLASTICS WEEK AT PARIS IN JUNE 1953.

A resume of items seen at the exhibition of plastics machinery and molded articles as well as papers presented.

DESIGN OF INJECTION MOLDS—Hans Gastrow

This article mainly consists in a juxtaposition of the structural elements of an injection mold with the different kinds of steel, alloy steel and grey cast iron and the most advantageous use of such materials for the individual parts of molds.

INSERTS IN PLASTICS — F. Walther.

In cases in which molded-in nuts cannot be used or scrap shall be avoided inserts are used as they have been introduced in the U.S.A. for some time. These steel or brass inserts have inner and outer threads, are of conical shape at the bottom and provided with several longitudinal slots. Due to the sharp edges of the slots, the insert cuts its own thread into the walls of the borehole. It may be inserted either by hand or with special tools. Removal of inserts upon unscrewing screws from the inserts is impossible since the friction between metal and plastic material is greater than between metal and metal. These inserts have proven very helpful with thermoplastics.

NEW GERMAN LITERATURE:

1. Farbenfabriken Bayer, Leverkusen

a. Mesamoll — Plasticizer for PVC.

b. Porofor BSH — Organic expanding agent yielding nitrogen, for expanded plastics.

c. Clophen — Dielectrics of oily to resinous properties which make them particularly suited as flame-resistant insulating and cooling oils for the electrical industry.

2. Badische Aniline & Sodafabriken, Ludwigshafen

a. Palatinol AH — An odorless plasticizer for PVC of favorable antifreezing properties and little volatility.

b. BASF Products for the Glueing and Bonding Industries—Listing all inherent raw materials for glues, plasticizers and solvents.

3. Farbwerke Hoechst AG., Hoechst

a. PV Orange GRL — A pigment for blending of plastics.

b. PV Yellow HR—A pigment for dyeing PVC and other plastics.

4. Vereinigte Ultramarinfabriken, Koeln

Metal Stearates — Properties, processing and uses of metal stearates in the plastics, lacquer, pigment and caoutchouc industries.

5. Harburger Eisen — und Bronzewerke, Hamburg-Harburg

Rationalization in the plastics industry is discussed and their double screw extruder considered from this angle.

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GREAT BRITAIN

BRITISH PLASTICS

Vol.26, No. 292, September 1953

Abstracter: E. A. J. Mol

THE CHEMISTRY OF UNSATURATED POLYESTER RESINS. C. P. Vale. pp. 327-332.

The chemistry of the esterification of mono and polybasic acids with mono and poly alcohols to form polyesters is briefly described. The description includes the use of unsaturated acids and alcohols, giving rise to the formation of polymerisable esters which can in their turn be copolymerized with monomers like styrene and acrylics.

The properties of the most common raw materials are discussed and examples of esterifications from the patent literature are given.

Special attention is paid to the thermosetting unsaturated alkyds, catalysts and promoters are listed.

The article is closed with a paragraph on the application of polyesters as, for instance, casting resins and as a base for low pressure reinforced laminates.

The 58 literature references, though by no means exhaustive, form a very useful basis for further investigations.

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MEXICO

MEIXCAN RUBBER AND PLASTICS

Vol. XV, No. 90, July 1953

Abstracter: John B. Ballard

MONSANTO MEXICANA IS NOW MANUFACTURING POLYVINYL CHLORIDE RESIN, OPALON 300—

Reports the fact that Monsanto Mexicana, S.A., is now manufacturing "Opalon," a polyvinyl chloride resin, at its plant near Mexico City. Also describes the organization of the Overseas Division of the Monsanto Chemical Co. and reports the visit of a number of Monsanto officials to Mexico City on the occasion of starting production.

(Please turn to page 38)

Western New England Programs

January 6—Mold Design
February 3—Mold Construction
March 3—Thermosetting Molding Technique
April 7 — Thermoplastic Molding Technique
May 5—Finishing, Inspection, and Packing
June — Golf Outing. Date to be announced
Place of Meeting—Terrace Dining Room, Terminal Building, Bradley Field, Windsor Locks, Connecticut.

SECTION NEWS

Edited by
Stanley Bindman
Jamison Plastic Corp.
71 E. Sunrise Highway
Freeport, New York

Weighed Feeding and Epoxy Resins Topics of Discussion At New York

Arthur M. Merrill

The New York Section held a regular dinner meeting on October 21 at the Gotham Hotel, with approximately 90 members and guests attending. Two talks were given at the technical session which followed the cocktail hour and dinner: "Weighed Feeding in the Plastic Industry," by E. A. Buechner, Glengarry Equipment Corp.; and "Araldite Epoxy Resins—Expanding Horizons," by E. N. Dorman, Ciba Co. Inc. The talk on weighed feeding was originally scheduled to be given by J. E. Currie, Glengarry vice president, who was unable to attend.

Mr. Buechner began his talk with a brief history of his company's entry into the plastics field with its machine, and a review of weighed feeding as applied to injection molding. Operating on the vibratory feeding principle, the Glengarry unit provides adjustable weighed charges accurate to within 0.2 gram and with a weight tolerance of less than 1% at all feeding rates. During the 16 months since the first Glengarry feeder designed for plastics was introduced on the market, units have been installed in 150 molding plants. Automatic in operation, the feeders are currently being made in three hopper capacity sizes to meet a wide range of requirements.

The speaker discussed some of the advantages to be gained by the use of weighed feeding in injection molding, including the elimination of short shots and overfeeding; more efficient injection ram operation because of full travel; savings in material averaging 4%; and the reduction of flash, sink marks, and internal stresses in the molded parts. Further work on the feeder is needed to provide self-compensation to adjust for variations in the molding cycle. Mr. Buechner concluded his talk with a demonstration of the Glengarry unit in operation.

Mr. Dorman stated that epoxy resins, in the uncured form, are characterized by the presence of highly reactive epoxy end groups separated by alkyl-aryl chains. They are prepared by reacting diphenols with epichlorohydrin to give a thermoplastic product. This product is then further reacted or cross-linked with amines, acid anhydrides, or other hydrogen-releasing agents to give the cured, thermosetting resin. This curing reaction or polymetathesis takes place without the evolution of water or volatile matter, and can be accomplished at room or elevated temperatures, depending on the curing agent used.

The properties exhibited by the epoxy resins include outstanding adhesion to nearly all materials; extremely low shrinkage during cure; excellent dielectric properties at both room and elevated temperatures; high mechanical strength; good chemical resistance; high thermal stability; outstanding water resistance; excellent fungus resistance; easy curing; marked dimensional stability; and no limit as to size of castings. Applications for the resins are in bonding, casting, coating, impregnating, and laminating.

President Saul Blitz, Tico Plastics, Inc., presided over the meeting and announced the appointment of a nominating committee to select a slate of candidates for the three vacancies in the board of directors next year. Voting will take place by mail ballot, and results will be announced at the Christmas meeting. Sam Silberkraus, Riverdale Plastics Development Corp., is chairman of the committee, and the other members are George B. Baron, Ideal Plastics Corp.; Harriman H. Dash, Arma Corp.; Arthur L. Gewertz, consultant; Guy Martinelli, Sylvan Plastics, Inc.; and Irvin I. Rubin, Robinson Plastics Corp.

Table favors were distributed through the courtesy of Renwal Mfg. Co. and Naugatuck Chemical Division, United States Rubber Co., and the meeting closed with a drawing for door prizes contributed by Leaf Plastics, Inc.; Monsanto Chemical Co.; and A. Schulman, Inc.

The following three new members were added by the New York Section during the past month: Abraham J. Falkin, Metalmold Forming Co.; Gerard H. Landsberger, sales representative, Admiral Plastics Corp.; and Samuel Zimmerman, president, Merit Creations, Inc.

Connecticut Section Sees Currie Demonstrate Weigh Feeding

David Mersey

The October meeting of the Connecticut Section was held on the 17th instead of the 10th so as not to conflict with the SPI meeting at Manchester.

The Glengarry Equipment Company was responsible for the program. Mr. J. E. Currie explained what his device would do, i.e., preweigh each shot of material before it entered the press. This idea of pre-weighing is new in plastics, however, it has been used in other fields for years. It has been used in pre-weighing and packaging bulk materials, such as, foods, drugs, chemical, etc. He also gave credit to John Grosbeck who, once seeing the automatic weighing and packaging of salt, suggested its application to injection molding. Gordon Thayer also predicted some type of pre-weighing device.

Edward Buchner assisted with a working model, showing how many and various shots were pre-weighed and then checked on a gram scale.

A number of features were stressed; these are in the economics and quality realized from using this unit. Although there is a substantial saving of material in using this unit, it is not one of the more important features. In pre-weighing each shot before it enters the press, 'shorts' and 'overs' are eliminated. Overs might result in packing each shot and excessive flashing. This results in an even distribution of material in the mold cavity so that the molded piece is free of stresses and strains. This means that annealing can be eliminated; and that the presses may be run at lower pressures. All of these features contribute to better quality.

Forty five members and guests were present at this meeting, this being the average turnout for this section.

Plea for More Realistic Approach to Plastics Standards Made At Toronto

A plea for "more realistic" standards for determining the acceptability of plastic parts and other molded pieces highlighted the October meeting of the Society of Plastics Engineers, Inc., held at the St. Regis Hotel here.

The need to employ practical performance criteria for plastic items, instead of carrying over the abstract measurement criteria established for metal fabrications, was stressed in a review of beryllium copper casting progress, made to the monthly gathering by Joseph P. Healey, sales manager of Manco Products, Inc., Melvindale, Mich.

Mr. Healey, national membership chairman of SPE and president of the Society's Buffalo section, charged that important advances in production efficiency and economy could be retarded by an insistence on the rigidly precise standards for metal items which frequently have no practical significance in judging plastic parts.

As examples of products to which arbitrary yardsticks have sometimes been incorrectly applied, he cited nylon gears—for aiding whose development Manco won a Canadian Plastics Award. These gears, he mentioned, are now being used to an increasing degree in the construction of automobiles, cameras, kitchen mixers, and other equipment.

The meeting was reminded that the nylon gears, which operate noiselessly without lubrication, cost mere "pennies" per unit—while far outlasting machined metal gears which cost "dollars" apiece. In the face of these advantages, Mr. Healy implied, it is not sensible to subject the molded gears to accuracy measurements and other tests which do not apply to them, although such tests may be requisite for the machined parts which offer less longevity and operational ease despite their higher cost.

The molding process does involve a slight variation of shape because of the shrinkage of the beryllium copper used in making the mold components and the shrinkage which can be compensated for in the original design.

Even when there is not exact adherence to the specifications which would be set for metal gears, Mr. Healy continued, the difference does not affect actual operation. On the contrary, he explained, the nylon parts may be expected to out-perform the metal ones even if they fail to meet the same abstract requirements. This is a fact, he contended, that some engineers ignore when they object to a minor difference in clearance that shows up when the involute of the plastic gears is checked against the pattern set by metal ones.

In calling for revised thinking about inspection methods, the Manco executive asserted that technicians are apt to be more critical of a part submitted to them than the ultimate customer ever would be or would need to be. He recommended that the engineer replace abstractions with a more "operational" frame of reference, based on what the final user of a specific part may expect of it. He illustrated that idea by stating that the method of projecting on a screen an image of a machine part enlarged 50 times might be valuable if experience showed that it successfully uncovered vital flaws in metal items, but would not necessarily have a realistic relation to the performance of plastic parts.

Misunderstandings and conflicts are apt to arise, the gathering was told, when the molder finds he is dealing with engineers who cling to non-applicable concepts of technical precision. In such an instance, Mr. Healy declared, the molder unused to such concepts is in the helpless position of "a neophyte in the hands of the experts."

Indicating that a converter like Manco could lead the molders' battle in pressing for a more common-sense attitude toward plastic design and performance, Mr. Healy added that the molders themselves must recognize the problem and work toward its solution.

Another point made to the SPE assemblage was the fact that the standards now existing for metal fabrications are the result of revised techniques and constant handling changes over a period of many years. Similar "evolution" is to be anticipated in beryllium copper casting, Mr. Healey noted, with a fund of technical know-how now available for solving special problems.

It was likewise maintained that the development of the beryllium copper process has created numerous plastics applications that industry is coming to take for granted. The utilization of nylon and polyethylene for many efficient parts at actual cost savings might otherwise have been subject to long delay and formidable expense, Mr. Healey told the meeting.

In stressing the statement that beryllium copper augments rather than replaces steel in plastics molding, Mr. Healey offered two questions to be employed as guides in determining its usage.

One query was: "Can this cavity be cut economically in steel, being a geometric shape that would lend itself to machining operations with standard machine tools?" The other was: "Is this part such that it can be cold hobbed without any problem of hob failure?"

If the answers to both questions are affirmative, the Manco official said, then steel should be used in preference to beryllium copper—unless experience has shown that the high thermal conductivity of the latter indicates advantages over steel in the complete run.

Mr. Healey also suggested that the final cost rather than the original cost should be considered as a deciding element. He urged that time and labor savings be reckoned when cost comparisons are undertaken.

"One example of the time factor which cannot be purchased with money," he said, "was a recent job which would have required a whole year of pantograph time to complete. With beryllium copper casting, the job was completed and running in three months, and continued satisfactorily for the millions of pieces in a kralastic material which were required."

Mr. Healey also discussed the savings in hob costs when multi-piece hobs are used in the casting process. He stressed the need for using proper grades of steel in constructing a master hob, to avoid distortion or collapse.

In other parts of his talk, Mr. Healey covered the advances in casting beryllium copper from beryllium copper in order to produce a finely detailed force from a male master rather than a female, the service now offered of casting from a model or pattern of a novelty or other item where dimensional tolerances are not critical, and the advantages of using beryllium copper in utilizing a hob to make one or more interim castings for sampling a market prior to adopting final production molds.

Neuman Opens New Plant

J. Neuman of NU—Mfg. Company, Chicago, Ill. announces the opening of a new plant—

Florida Mold and Tool Corp.,
603 Pinellas St.,
Clearwater, Florida.

The company will manufacture plastic molds and tools.

Molding Die Design and Manufacture Described by Andras at Miami Valley

John L. Russell

John Andras

John Andras, the personable Chief Engineer of the Major Mold & Die Co., Detroit, Mich., was the principal speaker at the October 1st dinner meeting at the Eaton Manor in Hamilton, Ohio, of Miami Valley Section SPE. 53 members and guests enjoyed a tasty chicken dinner and the fine program provided through the efforts of President Joe Merke and Acting Program Chairman, Merle Nelson. Among the guests included 4 from Inland Div., General Motors Corp., 8 from Recto Molded Products Co., 1 from Buckeye Molding Co., 1 from Dimco Co., and 1 from the Plastic Molding Corp.

Mr. Andras, in the main speech of the evening, gave the audience plenty to think about in his talk that included just about every phase of molding die design and manufacture. He advised the men to consider the part drawing to scan the drawing for radii that may cause feather-edging, to look at the mold design in terms of the machining required. Other questions that must be given consideration are the size of molds, whether cored openings, undercuts, location of ejector pins, floating plates, more than one sprue, and several different temperature water lines might be required.

An interesting and very informative forum before the main talk was participated in by the members. The questions discussed were:

1. What type of plastic can be plated—how large—can Styrene parts be chrome plated up to .010 thick, in pieces 26" x 4" x 3"?

2. What factors enter into choosing materials for any specific molded part?

3. What steps can be taken to prevent weld lines in polystyrene castings?

4. Would appreciate discussion of methods of training molders in regard to proper care of molds and equipment.

President Joe Merke announced the coming election of 3 new Directors to succeed outgoing Ralph Backscheider, Recto Molded Products Co., Carl Weber, Crosley Div., Avco Corp., and Otto Fiedler, F & F Mold and Die Co.

On November 5 Miami Valley Section will be guest of the Premier Rubber Co. in Dayton for a plant visit. Louis Jacobs is handling the arrangements. The Annual Christmas Party will be held again at the Miami Valley Golf Club in Dayton on December 18.

Southern California Hears Owens Describe Ion Exchange Resins and Their Uses

Austin H. Herbst

Mr. Dean L. Owens, technical representative of Rohm & Haas Company, spoke on the fundamentals of "Ion Exchange Resins and Their Applications" at the October meeting. Although the principle of ion exchange is "literally as old as the hills," the development of its practical uses was not possible until the discovery of the ion exchange properties of phenol formaldehyde resins in 1935. Since that time the rapid growth in applications and improvements in the properties of ion exchange resins has closely paralleled the growth and development of resins for the plastics industry.

Mr. Owens outlined the chemistry of several typical ion exchange resins including those based on polystyrene, and illustrated by means of schematic diagrams the principle of anion and cation exchange. Many industrial applications utilizing ion exchange resins were described including the production of demineralized water whose quality exceeded that of triple distilled water and at a considerable savings in cost.

The members and guests came to attention when the speaker mentioned that ion exchange resin beds had successfully removed experimentally certain harsh irritants from an inexpensive brand of whiskey to produce the equivalent of a premium grade whiskey from the standpoint of flavor and "day after" effects. If it should not be convenient to carry out this experiment in your own basement, an alternate process was suggested,—that of swallowing the ion exchange resins directly, thereby, allowing the reaction to proceed without muss or fuss.

Ion exchange resins are commercially available in tablet form to be taken orally for the relief of ulcers. Another type of resin will absorb salt from the body and permit patients with certain type of cardiac diseases to enjoy salt in their diet.

Ion exchange resins are playing an important role in the isolation, recovery and purification of trace elements and a great deal of work in this field has an important bearing in our atomic energy program.

Newark Hears Talk By American Airlines

Don Biklen

One hundred and five persons heard Mr. Tom Harris, Mgr. of Air Cargo for American Airlines, speak before the S.P.E. group at the Military Park Hotel in Newark, October 14. Mr. Harris's talk, "The Potentials of Plastics," as related to air service, was enthusiastically received.

An appropriate atmosphere was given the occasion with colorful airline posters hung about the room. Several attractive stewardesses completed the setting.

The speaker remarked how impressed he was by the enthusiasm displayed by men in the plastics industry. In air service, weight obviously is of prime importance and statistics were given on the savings appreciated for every pound reduction of dead load. American averages 14 hours and 36 minutes flying time per day on their Convairs. For every pound saved on each Convair, $604 can be saved in one year. Mr. Harris felt that the future looked bright for further applications of plastics to the airlines. Though air cargo service is less than passenger service, the speaker predicted that the air cargo service would soon equal the passenger service and then go well ahead of it.

High praise was given to the men in the plastics industry for their unceasing devotion to research and development of plastic materials. Following Mr. Harris's talk were numerous questions raised by the audience.

Bill Willert, secretary of the Newark Section, gave a financial report at the October 14 meeting and also announced that the Newark membership was now 347.

Rubber-Resin Blends are Topic At South Texas Section Meeting

W. E. Wiese

"Rubber-Resin Blends, Their Characteristics and Applications" was the topic of Mr. A. E. Polson's talk to the South Texas section on September 16, 1953. Mr. Polson is the sales service manager of the chemical division of The Goodyear Tire & Rubber Company and is recognized as an authority on this subject. He described the properties of several commercially important and some not yet commercial rubber-resin blends, their end uses, and the reasons why these products are superior to some alternate materials for selected uses.

Rubber-resin blends date back to the early 1930's and their major advance in importance occurred during World War II. They ingeniously combine the properties of both rubber and plastics. In some blends the rubber predominates and in others the resin predominates; thus, their properties can be varied from that of rigid materials to very flexible materials. Some require the addition of chemical stabilizers and curing agents and others do not.

Blends of rubber and styrene—butadiene resins in various proportions are perhaps the most important group today. Applications for this particular blend are familiar to everyone as golf ball covers, shoe soles and heels, rubber flooring, covering for luggage, and electrical insulation. Blending results in products having unusual impact resistance, abrasion resistance and flex life. Some other improved properties are obtained. These blends are possible with both synthetic and natural rubbers. Rubber plus styrene-butadiene resins are the most versatile blends and the ones which are available at the lowest cost.

Rubber also can be blended with polyvinyl chloride, the phenolic and styrene-acrylonitrile and other copolymers. These are of lesser importance but nevertheless are commercially available today. In each case, the properties of natural or synthetic rubbers and the plastic are modified through blending to obtain the most desirable properties of each component. In most cases the final product can be formed in conventional molding equipment.

The importance of blending can be illustrated by the annual domestic consumption of styrene-butadiene resins for this purpose. Last year 36,000,000 pounds went into shoe soles and heels, rubber floor tiles, and miscellaneous uses. The figures promise to be even higher during 1953.

Mr. Polson was introduced by our president, Mr. Jim Pinkston.

Chicago Panel on Expediting Delivery And Design of Molds

M. A. Self

The joint meeting for SPE-SPI was held Wednesday, October 21, with a larger number of members and guests being present than at any previous meeting known to the writer. A hundred and eighty-nine members and guests attended to hear a panel discussion on the subject of Expediting Delivery and Design of Molds. The discussion was moderated by Mr. John Press of the Federal Tool Corporation of Chicago and participating members of the panel were Mr. R. O. Schulz of the R. O. Schulz Company, of Elmwood Park, Illinois; Mr. J. M. Atols, Atols & Son, Chicago; Mr. John Andrus of Major Mold & Die Company, East Detroit, Michigan; and Mr. Ray Phillips of the Chicago Molded Products Company, Chicago. The discussion centered around improved design practices, improved drawings, and the information necessary to allow for proper fitting and building of molds at the minimum cost. The discussion of the problems of handling large molds was covered in detail. The meeting proved to be highly enlightening in gaining a better understanding of the problems of design and delivery of molds.

The meeting was held at the regular location at the Western Society of Engineers located at 84 E. Randolph.

Chicago extends an open invitation to all members of the plastic and related industries to attend our meetings held on the third Wednesday night of each month at the above address.

Ultra-Sonic Cutting Of Metal Described At Southeast Ohio

L. A. Monaco

An illustrated lecture on the ultra-sonic cutting of metals by Dr. Louis Balamuth, formerly of Columbia University, featured the October dinner meeting of the Southeastern Ohio Section of the Society of Plastics Engineers at the Beverly Hills Restaurant near Cambridge.

Dr. Balamuth, inventor of the Cavitron, used in the ultra-sonic cutting of metal, is one of the foremost authorities in his field. P. J. Underwood of Athens, national secretary of the society, also spoke and was introduced by the program chairman, Jack Knight. Acting president Paul Smith presided at the meeting.

There were more than 50 persons from 20 plastic and allied industries present at the meeting. The time and place of the next meeting will be announced at a later date.

Toledo Hears Talk on Plastic Phonograph Record Making

John C. Purdue

Mr. Larry Wood of RCA Victor Division was the featured speaker at the first fall meeting of the Toledo section, addressing members and guests on "Phonograph Record Manufacture," with emphasis on vinyl record making. The talk provided the high point of a dinner meeting.

Mr. Wood's talk was an interesting combination, being partly in a technical vein, and partly concerned with interesting sidelights of record manufacture. Many of the sidelights discussed play an important part in technical matters.

It was reported that all RCA Victor vinyl records are compression molded in production, and that they have been able to work out a 26 second molding cycle where one operator runs two molding machines. Although other manufacturers are doing a limited amount of production molding by injection techniques, RCA so far feels that compression molding is superior.

The popular record field is particularly difficult because the scrap which must be reworked includes not only flash and relatively high molding rejects, but also records returned by dealers who are allowed five per cent returns. The necessity for reworking this material makes it practically imperative for record companies to do their own compounding. Most of them buy the basic resins, mainly polystyrene for cost reasons, and produce their molding compounds from these resins, scrap, and filler. Pressures of 20 to 30,000 pounds per square inch under the stylus when a record is played militate against the use of plasticizers in the formulation. Mr. Wood reported that some work has been done with polyvinyl chloride, but that the molding cycle is approximately doubled when this material is used. Acrylics are excellent materials for making records, but their high cost militates against general use.

Northwestern Pennsylvania Section Welcomes A New Custom Injection Molder

Paul C. Roche

In November 1952 Buffalo Molded Plastics, Inc. was organized in Buffalo, New York for the purpose of engaging in the custom injection molding and finishing of products made from thermoplastic materials. This organization has grown to a point where their Board of Directors deemed it advisable to open another plant which is now known as the Erie Division. The two plants will operate as one with the Erie Division for the time being doing no finishing. The Buffalo plant is responsible for all Engineering, tool and die design on new jobs. They have their own tool and die shop which is incorporated in the Buffalo plant. All production will be coordinated through the New York office with the closest cooperation being given by the Erie Division. Production and Engineering know how are equally distributed in both plants and are interchangeable on a moments notice.

The plant in Erie, Pa. which now adds another to the list of top notch procedures in this area is located at 1810 West 20th Street. The building is new construction with all conveniences for molding incorporated in its design. The Management anticipates having six sixteen ounce molding presses in operation by spring. An addition has been added to the building giving it five truck level loading docks which is available should business conditions warrant immediate expansion.

During its first year the Buffalo Molded Plastics has enjoyed business relations with such concerns as The Rudolph Wurlitzer Co., General Electric in Erie, Syracuse and Utica, N. Y. Sylvania Electric Products, Carrier Corp., Lincoln-Mercury, Niagara Searchlight Corp., Sears Roebuck, Welsh-Allyn and many others.

One of the main reasons for the erection of a new plant is to have better control over all operations which will be beneficial to the company and its customers.

Officers and management of the combined operations consist of our familiar friends Charles Catalde, Gusatve Opel, William Holden, George Dudley and Donald Leet.

Plastics Design Is Discussed at West New England

E. J. Sweeney

The Western New England section held their regular monthly dinner meeting at Bradley Field, Windsor Locks, Connecticut. The speaker for the evening was Mr. Carl Otto, prominent Industrial Designer.

After dinner, Mr. Ed Childs, Section President, conducted a short business meeting calling on Ray Mazur, Membership Chairman, and Bill Bentley, Program Chairman, for reports.

Bill Bentley introduced Mr. Otto.

Mr. Otto stressed the designer attitude and problems. Quite often the design of a product requires special and complicated die tooling. The designer doesn't try for complicated setups, but is primarily interested in sales appeal. They try not to use plastics unless they feel that the use is best served by plastics. Sometimes they are caused by a client to use plastics because of its assumed sales appeal.

Mr. Otto used the Erno Laszlo, Cosmetic Line, designed in polystyrene as an example of use of a container to give character and prestige to a new line. He also cited the Schick "20" and the Edison Voice-writer case (mainly cast aluminum) as examples of industrial design for utility and eye appeal.

The talk was well received by the group.

After a short question period, Ed Childs called on Herb Hazenthal of Prophylactic for a few off the cuff remarks on his experience with designers. Herb rose to the occasion with his usual dry humor citing a recent job as an example of the molder's problem with the designer.

The product exhibit at the meeting contained examples of the type of molded parts now being supplied by Prophylactic. The plan is to have a product exhibit at each meeting.

We wish to call to the attention of prospective members that Western New England section is continuing their policy of a free dinner to those that sign up.

Cleveland-Akron Hold Joint Meeting With Rubber Group

Frank A. Martin

On October 23 the Cleveland-Akron Section joined with the Akron Rubber Group to hold their second cooperative meeting at the Mayflower Hotel in Akron. Like the first meeting, this one also was a success from every standpoint. A capacity crowd of approximately 700 members of the two groups attended a panel discussion during the afternoon. The panel arranged by the Cleveland Section discussed the subject of "Rubber-Resin Blends."

F. W. Stavely of Firestone Tire and Rubber served ably as the moderator. Each panel member in a short talk covered the background material of a particular rubber-resin blend, following which previously submitted questions were answered by the panel. Other panel participants and their topics were as follows: R. C. Bascom, Goodrich Chemical Company—Phenolic Resins with Rubber; Willard D. Crater, Naugatuck Chemical — Styrene Acrylonitrile Resins with Rubber; C. R. Holt, Marbon Corporation —Styrene Butadiene Resins with Rubber — Rigid Type; Harold B. Sell, Goodyear Tire and Rubber — Styrene Butadiene Resins with Rubber— Non-rigid Type; Walter J. Smith, Firestone Plastics — PVC with Rubber; and Dr. A. G. Urbanic, General Tire and Rubber Company — Other Blends — Present and Future.

Following a cocktail hour and dinner the guests were entertained by Mr. Charles W. Carvin, who is the unofficial raconteur of the textile industry.

PERSONALS

The Cleveland-Akron Section is sorry to lose as a member Mr. Z. N. Harris, who is moving to California. Mr. Harris will be associated with Extruders, Inc. as Assistant Plant Manager where he will work with another former member, Hans Buecken on vinyl extrusions. Zack after graduation from M.I.T. spent six years in the Engineering Department of National Rubber Machinery before taking his new position. All Cleveland members join in wishing Zack luck in his new surroundings.

Golden Gate Talk Is on Plastic Pipe

Richard M. Weber

For our October meeting the Golden Gate Section really pulled all the stops! Teaming up with the Northern California Chapter of the SOCIETY OF PLASTICS INDUSTRIES in a joint affair the attendance was two hundred and fifty-one, a splendid climax to the efforts of Presidents Roy Theiss (SPE) and John Steif (SPI) and their willing committees.

The subject of the gathering was PLASTIC PIPE. Mr. R. E. Deshon was the speaker. Mr. Deshon treated on the various types and materials, their applications and limitations, cost factors and how plastics pipe compares with metal and other pipe. There was also a display of many sizes, types and kinds of plastics pipe.

Members and guests wore identifying badges which contributed to the cheerfulness of the evening. The place of meeting was the Showboat at Jack London Square, Oakland.

Cavitron Cutting Is Described At S. E. Ohio

John Chomicz

The **Southeastern Ohio Section** of the SPE met on Thursday, October 22 at the Beverly Hills dining room located west of Cambridge, Ohio.

The Executive Secretary, P. J. Underwood, of the Society was a welcome guest. He gave a brief breakdown of his experience and training and how it correlated with the requirements of the National SPE organization. Jim explained to the members present that a membership drive has started, with the objective of obtaining 2,300 new members to increase the total to 5,000 in a twelve-month period.

The meeting was turned over to the Program Chairman, Jack Knight, who introduced the speaker, Dr. Balamuth of Cavitron Equipment Corporation, Long Island, New York. Dr. Balamuth illustrated his talk with slides in describing the cavitron method of cutting and forming cavities in hard steels by ultrasonic bombardment of the metal.

President Paul Smith:

(1) reported on the rules regulating payment of dues as outlined in the bylaws of the Society. It is required that members delinquent be suspended until payment is made. A request was made that delinquent members make immediate payment;

(2) brought up for discussion the SPE prize paper contest;

(3) appointed Len Monaco as SPE News Reporter to fill out the current year;

(4) reported on the use of the new type of application forms.

The minutes of the May and June meetings were approved as read by Secretary John Chomicz.

Treasurer Fred Burkhart reported on the financial condition of the Section.

Attendance at this meeting consisted of 22 members and 30 guests. It is hoped that forthcoming meetings will be attended as well when compared to the first meeting of the 1953-54 season.

Detroit Hears Talk On Quality Control

Don Hoffman

The Detroit Section of the Society of Plastics Engineers held a dinner meeting on October 16th at the Rackham Memorial Building. The speaker for the evening was Mr. Lawrence, Superintendent of Plant Laboratories of Monsanto Chemical Company. His talk was entitled "Statistical Quality Control," and proved to be of interest to everybody.

Schnur-Appel Offices

Schnur-Appel design consultants (formerly Martin Schnur Associates) have acquired new offices at 2165 Morris Avenue, Union, New Jersey.

Principles of the firm are Martin Schnur and Mel Appel.

A complete design service from the idea stage through product drawing is available. Facilities include a fully equipped model shop.

Northern Indiana Section Meetings

Philip A. Leonard

The October meeting of the Northern Indiana Section of the Society of Plastics, Engineers, Inc. held on Monday, October 12, 1953 in the Chamber of Commerce Building, Fort Wayne, Indiana was called to order by Mr. Wayne Pribble at 7:30 P.M.

The speaker for the evening, Mr. L. D. Maines of Bakelite Company was then introduced by Mr. Howard Turner and the meeting was turned over to him.

The first meeting of the 1953-54 season of the Northern Indiana Section of the Society of Plastics Engineers, Inc. was called to order by our president, Mr. Cecil Armstrong on Friday, September 18, 1953 at 8:00 P.M. in the Chamber of Commerce Building, Fort Wayne, Indiana.

Mr. Armstrong ask that we consider holding our meetings on a rotation basis in order to attract some of the visiting plastic engineers and also to start the meeting at 7:30 P.M. instead of 8:00 P.M. A short discussion was held and a motion was made and passed to rotate our meeting nights and to start the meetings at 7:30 P.M.

Mr. Wayne Pribble, our National Director, reported on the last business meeting of the National Society Council and the Secretary gave his report regarding membership, change of address and etc.

Having no further business the meeting was adjourned to allow Mr. Ferris Newman introduce the speaker, Dr. R. G. Nelb of Naugatuck Chemical Division.

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Dear Friends:

A recent issue of the Chicago Tribune carried an editorial entitled "Plastics—Phooey." The editorial writer evidently had purchased one of the fragile, poorly constructed toys and had a sad experience. His main complaint was the difficulty of repairing the plastics since it can't be soldered, welded or otherwise mended like his grandfather mended broken toys.

We people in the plastics business know how easy it is to cement plastics (if you know what material to use). Why don't you raw material people, who furnish the polystyrenes and acetates that go into toys, concentrate a little of your informative advertising on this field? Why don't you inform the public how to repair these products? Why not put out a mending kit of some type and include the proper cement and instructions for identifying the plastic material? If fact, this is such a good idea you should get together with us and we will put out these kits. Please don't tell anyone as this is a trade secret.

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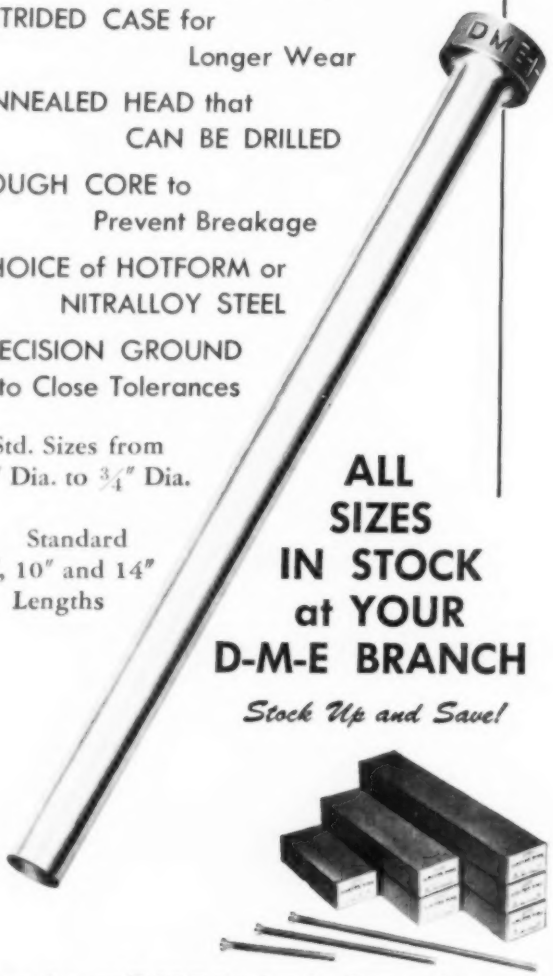

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Phenolic Foam

(Continued from page 15)

to be filled are of irregular contour, the savings in fabrication labor alone are often sufficient justification.

A recent flotation application for the Navy is an excellent example of the practicability of phenolic foam on a large scale use. Field fabrication with a "foamed-in-place" technique was undertaken under the most adverse of weather conditions. The operation was completed with a minimum of difficulty and it revealed some rather startling facts and figures. This application was formerly made with hand tailored balsa wood which then had to be fireproofed to prevent damage during subsequent welding operations. By switching to phenolic foam, the actual fabrication time was cut tremendously, no fireproofing step was required and the overall cost per cubic foot was reduced to ¼ of its former value. The pertinent statistics on this job have been assembled in Table VI. Life testing over a two year period under extreme service conditions has indicated no after shrinkage or tendency to settle. With increased defense efforts in the cards, large scale use of phenolic foam in this type of application is anticipated.

"Foamed-in-place" phenolics are also finding application in the aircraft industry as structural stiffners for wing assemblies and for the reduction of resonance vibration. It is also being used in the higher densities as a core material in tooling dies and jigs, where overall weight is a factor.

The economical production of low density foam slabs

Physical Properties of Phenolic Foam

Table IV

THERMAL CONDUCTIVITY COMPARATIVE PROPERTIES

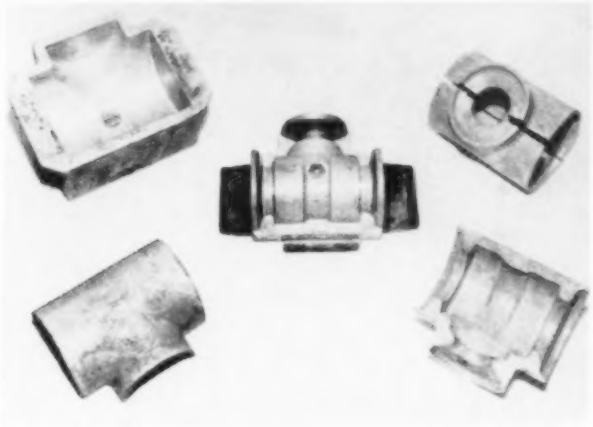
Material	Density (lbs./cu. ft.)	Mean Temp. (deg. F)	Conductivity (BTU/in./°F/ft²/hr.)
Phenolic Foam	1.7	73.7	0.24
Phenolic Foam	7.9	72.7	0.28
Corrugated Paper	1.9	75.0	0.26
Glass Wool	2.3	"	0.26
Cork Board	7.0	"	0.28
Rock Wool	6.0	"	0.26
Rock Wool	2.0	"	0.27
Fibre Board	12.0	"	0.31
Fibre Board	18.0	"	0.34
Hair Felt	9.0	"	0.26

Table V

SOUND ABSORPTION PROPERTIES OF PHENOLIC FOAM RESULTS OF A COMPARATIVE TEST

Frequency Range Cycles per Second	Transmission Loss Decibels	Frequency Range Cycles per Second	Transmission Loss Decibels
100	12.5	2500	28.5
200	17.5	3000	17.0
500	11.0	3500	13.5
1000	19.5	4000	9.5
1500	18.5	5000	2.5
2000	13.0		

Average transmission loss over entire range = 14.8 decibels.



Experimental production of pipe joint lagging "molded" of phenolic foam. Upper left and center are male and female halves of mold. Lower left and lower right are outer and inner sides of foam joint lagging. Upper right shows the two halves pressed together.

in the $\frac{1}{3}$-$\frac{1}{2}$ lb./cu. ft. range has opened up many new applications for phenolic foam. One of the most promising of these is its use as a packaging medium for fragile objects. Advantages over the conventional packaging materials are low weight per unit volume resulting in reduced shipping costs, reduced product breakage, reduction of packing time and less workers' fatigue. In addition, the good thermal insulating properties can be used advantageously for packing perishable products. The foaming apparatus can be set up in the shipping room itself, thus insuring a steady supply of packing material at the proper time and with less of the valuable shipping space being held up due to storage of unexpanded resin. Phenolic foam for packaging is just getting underway, but it appears to have a very bright future.

These same low density foam slabs are also giving promising results in thermal insulation applications. Of particular interest is their combination with honeycomb core material in lightweight building panel construction. By choosing a foaming formulation to give a less resilent type of product, the expanded slabs can be pressed into the honeycomb with only a slight degree of compression. If suitable skin panels are then bonded to the honeycomb-foam core, the result is a lightweight panel board in which the structural strength is obtained from the skin-honeycomb while thermal insulation is obtained from the foam. This should find volume usage in prefabricated housing and partition panel construction. For those applications where additional structural strength is desired from the foam, the foam can be "foamed-in-place" within the honeycomb cells, but at a much higher foam density. Since this raises the costs appreciably, it would not seem to hold as much promise as the other method.

Highly efficient insulating batts can be manufactured from certain types of low density slabs. By carefully compressing a $\frac{1}{3}$ lb./cu. ft. slab to a density of about $\frac{3}{4}$ lb./cu. ft., a resilient batt with a thermal conductivity of about 0.22 BTU/in./°F/ft² hr. is obtained. The compression of the foam has reduced the heat losses from conduction and in addition has produced an economical product which is much easier to handle.

The use of phenolic foam for sound deadening purposes has barely been touched to date. This could well

(Please turn to page 37)

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Basic Factors in Transfer Molding by Frank J. Donohue, page 18, No. 4, April 1953

Basic Principles of the Injection Molding Process by C. E. Beyer and R. B. Dahl, (1st prize 1952 contest) page 6, No. 2, February 1953

Biaxially Oriented Methacrylate and Polystyrene Sheet by C. Paul Fortner, page 21, No. 5, May 1953

Biology of Plastics by Louis C. Barail, page 14, No. 1, January 1953

Changes in Cross-Section on Extrusion by Zvi Rigbi, page 22, No. 7, September 1953

Closed Mold Molding Techniques by Edward Borro, page 10, No. 4, April 1953

Compounding and Processing of Rigid Polyvinyl-Chloride by Robert J. Ettinger, (honorable mention 1952 contest), page 16, No. 2, February 1953

Design of Screws for Polyethylene Extrusion by J. M. McKelvey, page 12, No. 3, March 1953

A Dreamer's Future for Plastics by Jerome Formo, page 10, No. 1, January 1953

Dynamic Mechanical Properties of Plastics Materials by L. E. Nielsen and Rolf Buchdahl, page 16, No. 5, May 1953

Engineering Design for Rubber Phenolics by A. P. Landall, page 10, No. 5, May 1953

Electrostatic Properties of Rubber and Plastics by H. A. Endres and Ward T. Van Orman, page 26, No. 2, February 1953

Extrusion Trends by M. S. Greenhalgh, page 7, No. 1, January 1953

Flow of Plastics Melts Through Dies by J. P. Tordella, page 6, No. 5, May 1953

Forum on Printed Circuits by Edward Drinkwater, George de Beaumont and Arnold Babble, page 11, No. 8, October 1953

Forum on the Education of the Plastics Engineer by C. C. Winding, Edward S. Bloom, R. C. Bartlett and Bryce Maxwell, page 18, No. 8, October 1953

Glass-Bonded Mica by J. H. DuBois, page 20, No. 4, April 1953

Injection Molderscope by A. R. Morse, page 22, No. 1, January 1953; page 56, No. 2, February 1953; page 46, No. 3, March 1953; page 30, No. 4, April 1953; page 28, No. 5, May 1953; page 58, No. 6, June 1953; page 26, No. 7, September 1953; page 28, No. 8, October 1953; page 25, No. 9, November 1953, page 25, No. 10, December 1953.

Injection Molding of Elastomeric Vinyl Materials by Frank A. Martin (3rd prize 1952 contest) page 12, No. 2, February 1953

Large Mold Construction by John Andras, page 7, No. 6, June 1953

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Multi-Screw Extrusion of Rigid Vinyls by S. H. Greenwood, page 20, No. 3, March 1953

New Process for the Manufacture of Furfural Alcohol Resin Intermediates by Erik Nielsen (2nd prize 1952 contest), page 10, No. 2, February 1953

Operating Characteristics of Extruders by J. F. Carley, page 9, No. 3, March 1953

Phenolic Foam by J. D. Nelson, page 13, No. 10, December 1953

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Plastics in Surgery by Albert Lightbody, page 23, No. 3, March 1953

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Plastics Problems in Electric Motors by Otto Wulfert, page 30, No. 3, March 1953

Plastigels-Production and Uses by Edward T. Severs, page 13, No. 6, June 1953

Polystyrene Foam by R. N. Kennedy, page 11, No. 10, December 1953

Polystyrene Reinforced With Glass Fibers by H. G. Guy, page 16, No. 8, October 1953

Preheating of Preforms, by Edward W. Vaill, page 7, No. 4, April 1953

Principles of Plastics Screw Extrusion by W. L. Gore, page 6, No. 3, March 1953

Printed Circuits by Norman Skow, page 9, No. 7, September 1953

Reinforced Plastic Tubing by Robert Barnett and H. B. Atkinson, Jr., page 22, No. 8, October 1953

Retailer Looks at Plastics by Ephraim Freedman, page 13, No. 8, October 1953

Some Reminders in Mold Construction by Rene Magnenant, page 9, No. 6, June 1953

Successful Designing for Plastics Molding by W. M. Halliday, page 20, No. 1, January 1953; page 24, No. 7, September 1953; page 25, No. 8, October 1953

Statistical Study of Extrusion Variables by R. E. Colwell, page 16, No. 6, June 1953

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Techniques of Injection and Compression Molding of Polytrifluorochloroethylene by Carmen R. Giannota, page 38, No. 2, February 1953

Tomorrow's Roll Surface Temperature Control and New Press Heating Systems by Paul Geiringer, page 32, No. 2, February 1953

Triallyl Cyanurate in the Preparation of Heat Resistant Resins by H. M. Day and J. G. Affleck, page 22, No. 2, February 1953

Unplasticized PVC by George S. Laaff, page 14, No. 7, September 1953

Vacuum Forming by Robert Butzko, page 26, No. 4, April 1953

Vacuum Forming by E. B. Stratton, Jr., page 24, No. 4, April 1953

Vinyl Compounding—A Symposium, page 20, No. 9, November 1953; page 21, No. 10, December 1953

Vinyl Floor Coverings by R. K. Petry, page 36, No. 2, February 1953

Phenolic Foams

(Continued from page 35)

prove to be one of the best applications, particularly since more economical foams are now available.

Table VI

FLOTATION APPLICATION WITH "FOAMED-IN-PLACE" G-E 12313 PHENOLIC RESIN

	G-E Foam*	Similar Application With Balsawood
Volumes Involved	8,098 ft³	4,928 ft³
Labor	$2.05/ft³	$14.10/ft³
Overhead	$0.95/ft³	$ 8.45/ft³
Material	$3.88/ft³	$ 5.07/ft³
Total Cost/ft³	$6.88/ft³	$27.62/ft³
Overall Installation Time	70 days	167 days
Installation Time/ft³ including non-working shifts	12-½ min.	49 min.

*Average density (without skin) = 1.7 lbs. ft³
Average buoyancy (24 hrs. under 30 ft. head water) = 38 lbs. ft³

The use of phenolic foam in home insulation has always been an intriguing one. The idea of shipping a drum of resin to a building under construction and then installing a permanent "foamed-in-place" insulation has fired the imagination of many a person connected with the building trade. The resultant product certainly has most of the desired requirements: excellent insulation, fire resistance, non-settling, ease of installation and permanence. Unfortunately, costs are entirely out of line with the techniques and materials as they are known today. This is not to say, however, that some means will not be devised in the future to change this picture entirely.

As with most new product developments, there is very seldom any one material which possesses all of the desirable characteristics. This is certainly true of expanded plastics. With its self-fabricating characteristics, excellent thermal and acoustical properties, heat and fire resistance and moderate cost, phenolic foam has a sufficient number of advantageous properties to give it serious consideration in a wide variety of jobs. If by concerted developmental effort, some of the other desirable properties such as improved toughness and cellular formation can be incorporated in phenolic foam formulations, then expanded foam will indeed be a material to be reckoned with.

Blower Catalogue

Billmyre Blower Division, Lamson Corporation, Syracuse, N. Y., has published Bulletin B-6 which catalogs products of the division. This two-color, 32 page bulletin includes information on centrifugal blowers and exhausters for air or gas handling.

Copies of Bulletin B-6 are available directly from Lamson Corporation, Syracuse, N. Y.

Sterling Brochure Ready

Sterling, Inc., bulletin 551, describes their mold temperature control unit. Write to Sterling, Inc., 3738 North Holton St., Milwaukee 12, Wisc.

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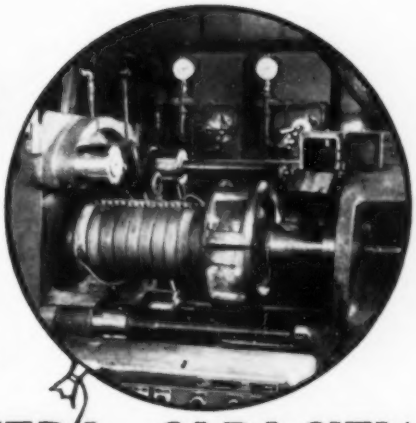

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Cellular Plastics Are Discussed at Eastern New England Section

Frank C. Dooley

The Eastern New England Section of the SPE has enjoyed a very successful fall season, which consisted of the following two meetings:

September 24th

The dinner dance for members and their wives and guests was held on Thursday, September 24, 1953, at the Hotel Beaconsfield. The evening featured a social hour at 6:00 P.M., a banquet at 7:30 P.M., following which those attending enjoyed dancing for the remainder of the evening. The function was well attended and enjoyed by all.

October 22nd

On Thursday, October 22, 1953, the Second Fall Technical Meeting of the SPE was held at the Hotel Beaconsfield Ballroom. There was a social hour from 6 p.m. to 7 p.m., followed by dinner. On this program two speakers were featured.

Mr. Robert F. McTague of Stanley Chemical Company spoke on vinyl and plastic sponges. The title of his talk was "Cellular Plastics." His informative dissertation held the interest of all, as he discussed in detail the wide use of cellular plastics for structural applications, sound-deadening, thermal insulation, body and head protection, and buoyant marine structures.

The second speaker was Mr. Edward L. Smiley of Tracerlabs, Inc. whose lecture was entitled "The Beta Guage in Plastics." He discussed the basic operating theory of this guage and its successful applications today in the plastics industry.

This meeting was exceptionally well attended.

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Plastics Around the World

(Continued from page 27)

★

SPAIN

REVISTA de PLASTICOS

Vol. 4, No. 21, May-June 1953

Abstracter: John B. Ballard

THE PLASTICS PAVILION IN THE 21st INTERNATIONAL SAMPLE FAIR IN BARCELONA, SPAIN.

Several articles, and 12 pages of photographs of 69 different exhibits of plastic products and equipment, at this year's industrial exhibition in Barcelona. No indication that there were any U. S. Exhibitors.

ABOUT THE REACTIONS OF ACETYLENE WITH FORMALDEHYDE—Prof. Dr. W. Reppe

A very complete discussion of the chemistry of acetylene and formaldehyde and the end products of these materials—by a director of the Badische Anilin & Soda-Fabrik of Ludwigshafen, Germany.

★

UNITED STATES

Abstracter: J. J. Lamb

LAMINATED GLASS CONSTRUCTION WITH SPECIAL REFERENCE TO BOATS

by Cmdr. Arthur C. Bushey et al., U. S. N. Bureau of Ships, Feb. 26, 1952, 84 pages. Library of Congress Catalog Card No. 52-61907.

A complete discussion of present methods of making glassfiber polyester boats with descriptions of the Beetle, Marco-Muskat, and Winner methods. The Marco-Muskat method, using both vacuum and pressure on the resin, is considered best.

Fillers, resins, activators, making of molds, temperatures and times of molding, parting agents, honeycomb cores, and incorporation of ribs are described. In some cases the resin content was as high as 75 percent, but the finished boat was satisfactory. Corresponding low flexural strengths were only 10,000 to 14,000 psi. Tests were also made on screw-holding strengths and on T-beams of glass-polyester. T-beams loaded on top were twice as strong as tested inverted. Beams of ½"x4" stem and flanges of 5 16" x 15" tested on a 7 ft. span broke under a 4000 lb. load on the center of the span.

The authors advocated the use of cellulose acetate honeycomb and epoxy adhesives for attaching fittings. Details were given on how to correct dry spots on the molding and how to make repairs to the laminate. The authors were enthusiastic about this application of polyester-fiberglass.

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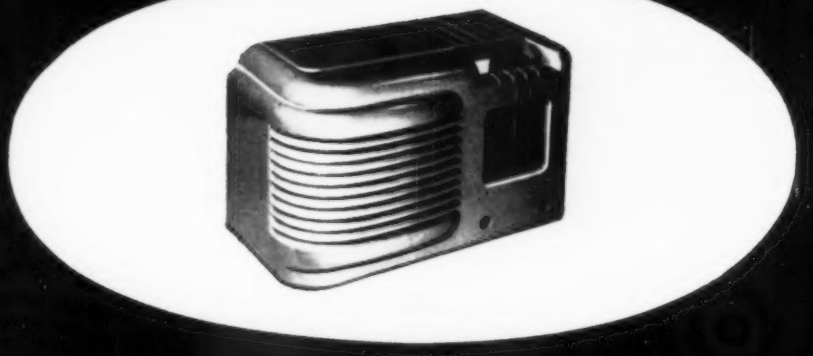

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